supracon ®
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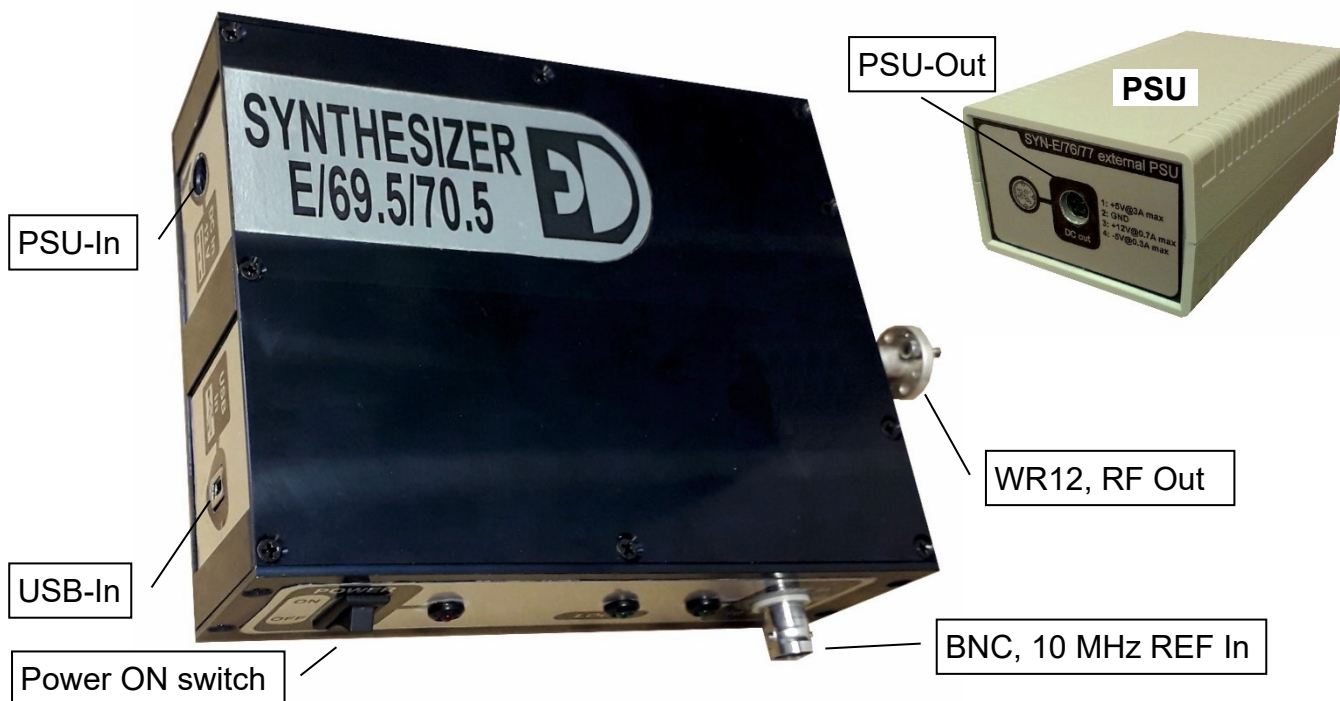## Manual 70 GHz Synthesizer

October 2021

Synthesizer used for Josephson voltage standard applications

Specifications:

Frequency range:	69.5 GHz – 70.5 GHz
Frequency accuracy:	same as external 10 MHz reference, ($\Delta f/f < 10^{-10}$)
Frequency resolution:	1 kHz
RF output power:	170 mW minimum
Output Power Attenuator Range:	≥35 dB
Output Power Attenuator Step:	≤0.1 dB
Phase noise:	<-10 dBc @ 1 kHz offset <-60 dBc @ 1 MHz offset
External reference input:	10 MHz, BNC connector
Remote control:	USB, mini
PLL indicator for phase locking:	yes
Output waveguide:	WR12
Dimensions:	H x B x L = 150 x 46 x 120 (in mm),
Weight:	0.96 kg
Power supply unit (PSU):	external AC/DC, (is delivered)

Supracon AG
An der Lehmgrube 11
07751 Jena
Germany
Tel.: +49-(0)3641-2328100
Fax.: +49-(0)3641-2328109
info@supracon.com

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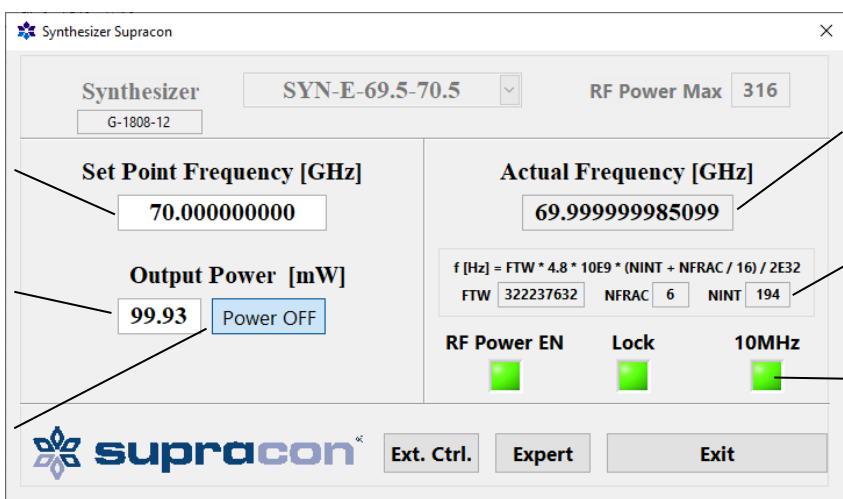
Manual 70 GHz Synthesizer

How to use:

To prepare for the use, follow the steps:

- Carefully read this manual and install software to your PC (D:\Software_Synthesizer-Supracon\Setup\setup.exe);

- Copy your configuration (e.g. "Config_SYN-12.ini") to a location on your computer, you have to choose this file after starting the software for the first time;

- Remove the protective covers from the waveguide and coaxial elements;

- Put the power switch of the synthesizer and external PSU to «OFF» position and connect the DC/DC external power supply cable;

- Connect the external PSU to a power source (230V ac or 12V dc);

- Connect the USB cable to the «USB in» socket on the synthesizer and to PC;

- Connect 10 MHz reference to the «REF In» socket on the synthesizer; (if connected, the synthesizer lock automatically)

- Put the power switch on rear panel of the PSU to the «ON» position, and make sure that the ON/OFF LED indicator is active;

- Put the power switch on front panel of the synthesizer to the «ON» position, and make sure that all LED indicators are active;

- Run the tool «Synthesizer Supracon» on your PC, and configure frequency and RF power.

  Device is ready for use!

Remote control: «Synthesizer Supracon»

Remote device management is carried out on the USB-HID interface. For the connecting to a PC (HOST) the device (CLIENT) provides a mini-USB socket («USB In»). For remote control, you can use the software tool «Synthesizer Supracon» in the sales package. The software is self-explanatory. You can also write your own application by using .dll.

Input desired frequency

Input desired RF power

RF power ON/OFF button

Synthesizer Supracon

Synthesizer   SYN-E-69.5-70.5   RF Power Max 316
G-1808-12

Set Point Frequency [GHz]
70.000000000

Actual Frequency [GHz]
69.999999985099

f [Hz] = FTW * 4.8 * 10E9 * (NINT + NFRAC / 16) / 2E32
FTW 322237632   NFRAC 6   NINT 194

Output Power [mW]
99.93   Power OFF

RF Power EN   Lock   10MHz

≋ supracon®   Ext. Ctrl.   Expert   Exit

Real frequency

Frequency setting parameters

Status LEDs

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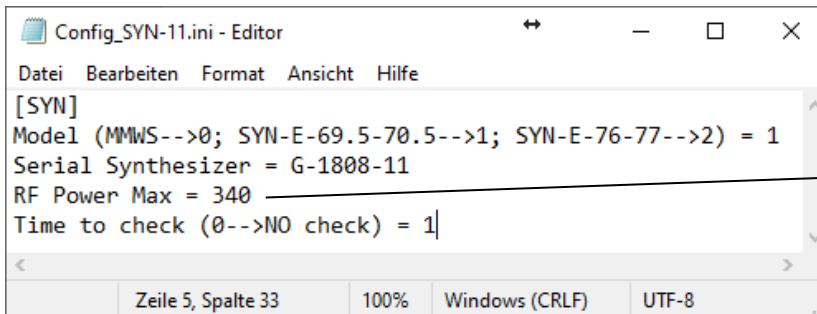info@supracon.com

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The output frequency (*RF*) is associated by the following expression:

- $RF[Hz] = \dfrac{4.8 \cdot 10^9 \cdot \left(NINT + NFRAC/16\right)}{2^{32}} * FTW$;

  were NINT, NFRAC, FTW are integers and for current RF band (69.5÷70.5GHz) in the following range:

  - $FTW = [322218271 \dots 322322646]$;

  - $NINT = [192 \dots 195]$;

  - $NFRAC = [1 \dots 16]$;

- The software displays RF-frequency with mHz resolution, and also *FTW, NINT and NFRAC* for calculation more digits.

- The output RF power is adjusted by a DAC controlled RF attenuator.

  The RF power resolution can be calculated from the maximum power (typically >170 mW, details see individual specification sheet) and the attenuator steps (typically <0.1 dB, details see individual specification sheet). The minimum power is given by the maximal attenuation (typically >35 dB, details see individual specification sheet).

```
Config_SYN-11.ini - Editor                          —   □   ×
Datei  Bearbeiten  Format  Ansicht  Hilfe
[SYN]
Model (MMWS-->0; SYN-E-69.5-70.5-->1; SYN-E-76-77-->2) = 1
Serial Synthesizer = G-1808-11
RF Power Max = 340
Time to check (0-->NO check) = 1

        Zeile 5, Spalte 33    100%   Windows (CRLF)   UTF-8
```

Maximum RF power can be changed in the config file

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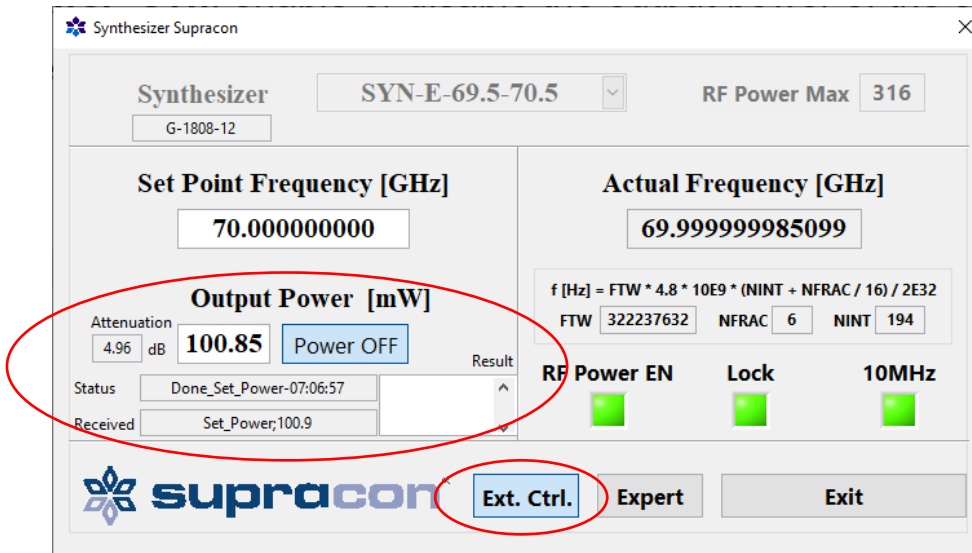
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32bit DLL library

➔ For testing the DLL there is an example program (LabView Version 2018) how to use this DLL in other programs. It's located at:
"C:\Program Files (x86)\Synthesizer_Supracon\data\Test_DLL_synthesizer.vi"
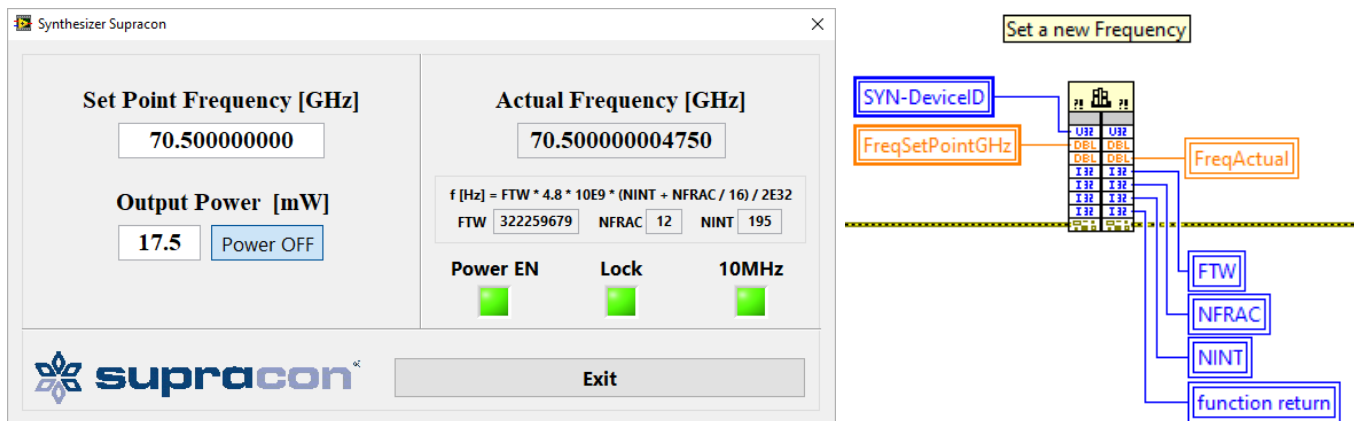
➔ There 6 functions to use the synthesizer. At first you must initialize (Init_Syn) the synthesizer, then you can work with it (Read_Syn, Set_Frequency_Syn, Set_Power_Syn, Switch_Power_Syn) and at the end you must close the connection of the synthesizer. Please have a look to program: "Test_DLL_Synthesizer.vi".

- Command **Init_Syn**: Initialisation of the synthesizer

  o void Init_Syn(uint32_t *SYNDeviceID, uint32_t *MaxPower double *FreqActual, double *Power, double *AttMax, LVBoolean *_10MHz, LVBoolean *PowerEN, LVBoolean *Lock, int32_t *FTW, int32_t *NFRAC, int32_t *NINT, int32_t *functionReturn, TD1 *error)

- Command **Close_Syn**: close the connection of the synthesizer

  o void Close_Syn(uint32_t SYNDeviceID, TD1 *error)

- Command **Read_Syn**: read frequency and power of the synthesizer

  o void Read_Syn(uint16_t MaxPower, uint32_t SYNDeviceID, double *FreqActual, double *Power, LVBoolean *_10MHz, LVBoolean *PowerEN, LVBoolean *Lock, int32_t *FTW, int32_t *NFRAC, int32_t *NINT, int32_t *functionReturn, TD1 *error)

- Command **Set_Frequency_Syn**: write a new frequency to the synthesizer

  o void Set_Frequency_Syn(uint32_t SYNDeviceID, double FreqSetPointGHz, double *FreqActual, int32_t *FTW, int32_t *NFRAC, int32_t *NINT, int32_t *functionReturn, TD1 *error)

- Command **Set_Power_Syn**: write the new output power to the synthesizer

  o void Set_Power_Syn(uint32_t SYNDeviceID, double Power, double AttMax, uint16_t MaxPower, int32_t *functionReturn, TD1 *error)

- Command **Switch_Power_Syn**: enable or disable the output power of the synthesizer

  o void Switch_Power_Syn(uint32_t SYNDeviceID, LVBoolean *PowerON, TD1 *error)

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External Control of Synthesizer Software via TCP

How to communicate with Synthesizer-Supracon via TCP

To use this option, you must know the IP address of the computer and you have to send/receive all commands to port 31180. If you are using different computers, both must be in the same network and your firewall must allow the commands in both directions. The number of allowed bytes for the sending commands (Parameter PARA and DATA) is written in the table "➔ Send Commands" below. You get an error "…error command…" if the number of bytes is not correct or if values are out of range.

➔ **TCPCP** Frame Format

Instruction Send 1 Byte	Bytes to Send/Receive 2 Byte (0…65535)	Data Send/Receive 0…65525 Byte	Read Status Receive 2 Byte
Send Command 1	Send 2 Byte	Please refer to the list: Send Commands	OK
Read Result 2	Receive **4 Byte**	Please refer to the list: Read Results	-
Ask Status 3	Receive 2 Byte	Please refer to the list: Ask Status	-

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➔ Send Commands

CMD	PARA	DATA
Activate_Power	ON/OFF [2…3Bytes]	
	Explanation Example	- If the Parameter = ON, the output of synthesizer will be switched ON - If the parameter = OFF, the output of synthesizer will be switched OFF **Activate_Power;ON**
Set_Power	From 0 to maximum output power e.g. 340mW [1…3Bytes]	
	Explanation Example	- Sets the output power of the synthesizer to the value between 0 and maximum output power in milliwatts with 2 decimal digits. It's limited to the attenuator resolution of 0.1dB. For this reason, the set result can be read back. **Set_Power;123.45**
Set_Frequency	From 69500000000 to 70500000000 [11Bytes]	
	Explanation Example	- Adjust the output frequency usual value **Set_Frequency;70100000000**

➔ Read Results

CMD	Executed Command	Results to be read (examples)
2 bytes	Activate_Power;ON	-
2 bytes	Set_Power;100.40	Actual Power [mW] = 100.34
2 bytes	Set_Frequency;70100000000	Actual Frequency [Hz] = 70099999987.939

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➔ Ask Status

CMD	Message	Explanation
3	…waiting…	AC-supraVOLTcontrol is waiting for a command to control something of the PJVS system.
3	…processing…	The software received the command and is processing the command at this time.
3	...error command...	There is some fault in the command, e.g. the length of the command is not correct, a parameter is missing or a parameter is out of the permissible range
3	Done_Set_Frequency-13:37:27	E.g.: the command Set_Frequency was executed successfully at the given time.

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➔ Example how to control the Synthesizer Supracon from an external software

- You must know and enter the correct IP address of the system where the Synthesizer Software is running, in case of using the same computer you could leave this textbox free
- The correct communication port (31180) is considered.
- It's possible to send commands
- You can ask the status of the PJVS system and whether the command is still running.
- If the status gives the message that the command was executed you receive the result by pressing the "Receive Result" button.