Programmable RF Signal Generator

DPL-3.2GXF

User's Manual

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DPL-3.2GXF is a wide band synthesizer utilizing 48 bit DDS(Direct Digital Synthesizer) and PLL(Phase Locked Loop) technique. It provides pure sine wave signal output from 5MHz-3.2GHz in 0.001Hz steps. The stable output level has been achieved in the range of -40dBm-+14dBm with ALC function. DPL-3.2GXF is having internal 10MHz clock reference and might be used as not only a stand-alone synthesizer but also the clock source for embedded system. In case the accurate 10MHz clock is available externally, the frequency stability can be improved. Parameter settings such as frequency, output level and so on can be controlled by serial data which is connected to PC communication port and can be memorized into EEPROM. An optional board , FIX-3.2GX is available to control any settings without using a PC.
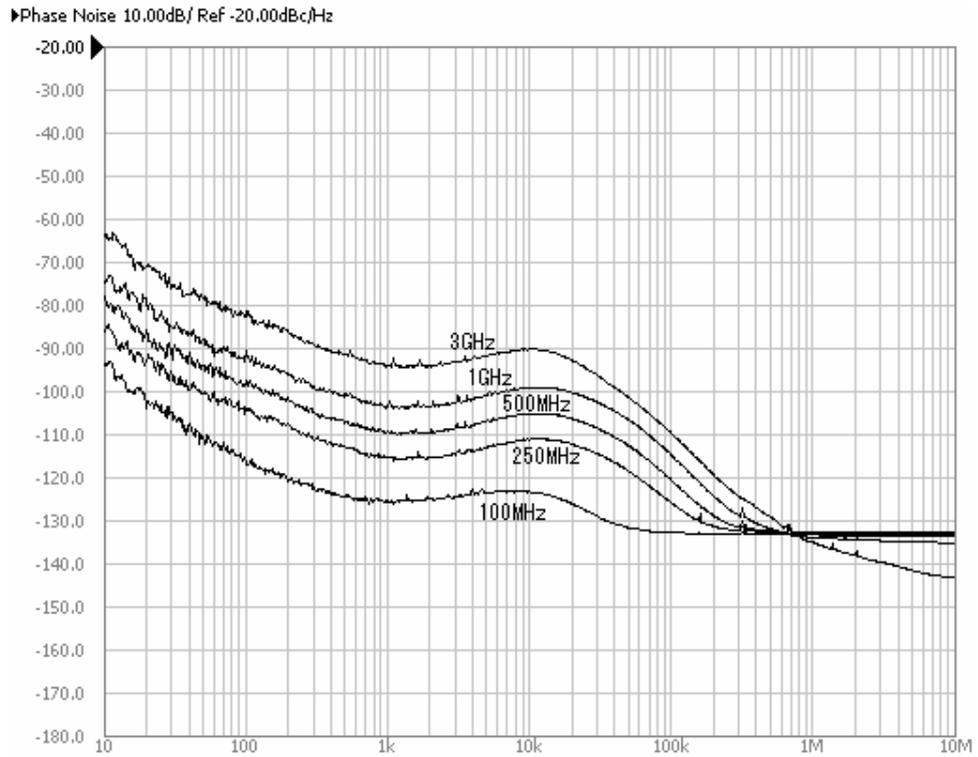
■　Specification

| Power supply | +4.75V～+7V　1.5A |

**Be careful with voltage drop of power supply line. If the supply voltage at power input terminal is lower than 5V, the maximum output level and spurious would be worse.

Frequency range	5MHz～3200MHz
Frequency resolution	0.001Hz
Output level	+14dBm～－40dBm
RF OFF output level	－60dBm or less
Output level accuracy	±1dB or less(output level　－30dBm or more) ±2dB or less(output level from　under －30dBm　～－40dBm exclusive)
Output level resolution	0.1dB
Phase offset range	-360.0°　～+360.0°
Phase offset resolution	0.1°
Output impedance	nominal 50Ω
Spurious	－60dBc or less

| Harmonic spurious | －30dBc or less |
| | (When the output level is from +10dBm to -30dBm, and supply voltage is from 5V to 7V) |

Internal reference clock
      Frequency accuracy   ±2.5ppm or less(0℃～+50℃)
      Long term frequency stability   ±1ppm or less per year

External reference input
      Frequency   10MHz
      Input level   +6dBm(±3dB)
      Impedance   50Ω

Interface
      Type   Asynchronous serial data RS-232C
             Use a straight cable for PC serial port

      Connector   D-Sub 9 pin

Environmental condition
      Operating temperature range   0℃～+50℃
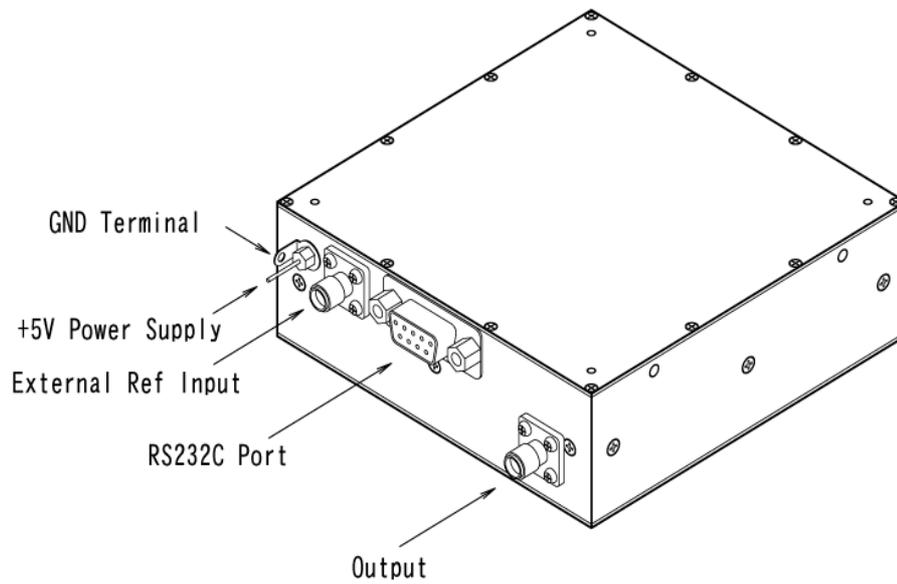
Dimension   W100xH35xD100(mm)

Weight   300g

■ Phase Noise(Typical) under the internal reference clock mode

(Unit is in dBc)

Freq.[Hz]	Offset from Carrier[Hz]						
	10	100	1K	10K	100K	1M	10M
3G	−63.7	−80.8	−93.0	−90.5	−109.9	−136.1	−145.0
1G	−74.9	−93.1	−104.1	−99.4	−115.0	−134.0	−135.2
500M	−78.5	−98.0	−110.6	−105.5	−120.9	−134.1	−134.5
250M	−85.0	−103.2	−115.6	−111.4	−126.0	−133.2	−133.3
100M	−92.5	−115.1	−125.9	−123.6	−132.5	−132.8	−132.8

Phase Noise 10.00dB/ Ref -20.00dBc/Hz

■ Terminal

GND Terminal

+5V Power Supply

External Ref Input

RS232C Port

Output

1. 5V Power supply terminal
   Connect +5V ±5％the power supply having more than 1.5A current capacity .
2. Ground terminal
   Connect the ground of the power supply
      (Caution : Do not touch + side of the power supply to the ground. To use a heat
      shrinking tube is recommended for its protection)
3. External reference clock input terminal
   Apply 10MHz reference clock to this connector(SMA) which has 50Ω input
   impedance. The external clock mode must be selected.
4. RS-232C port
   This is a connector for serial communication for setting frequency and output level
   and so on. Interface is RS-232C. Use a D-sub9 pin(male)connector and a straight
   cable for PC serial port.
5. Output port
   This is a connector of output signal. Use SMA(male)connector.

■　Outline Dimension

Mounting Holes M3-4PL
Same mounting holes on the other side.
Hole Depth 10mm

31.2

20

80
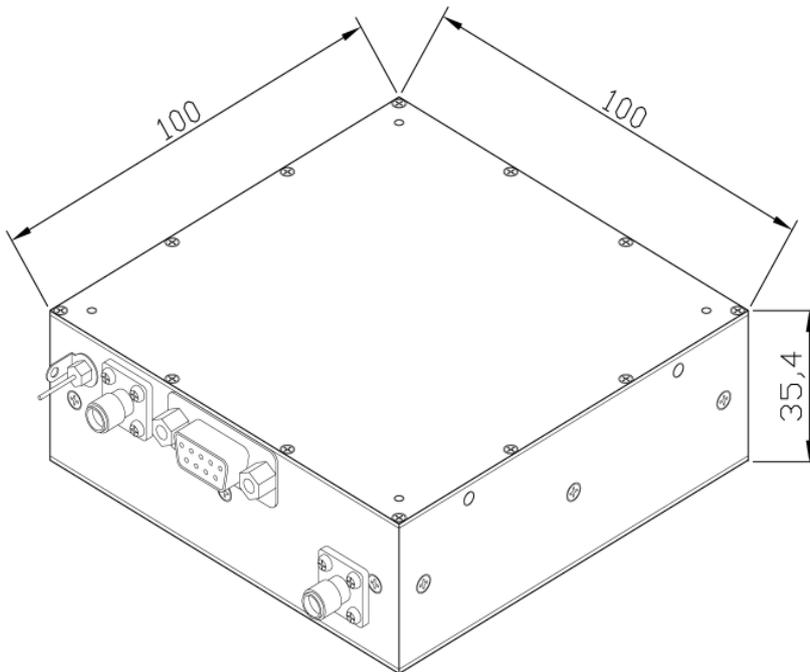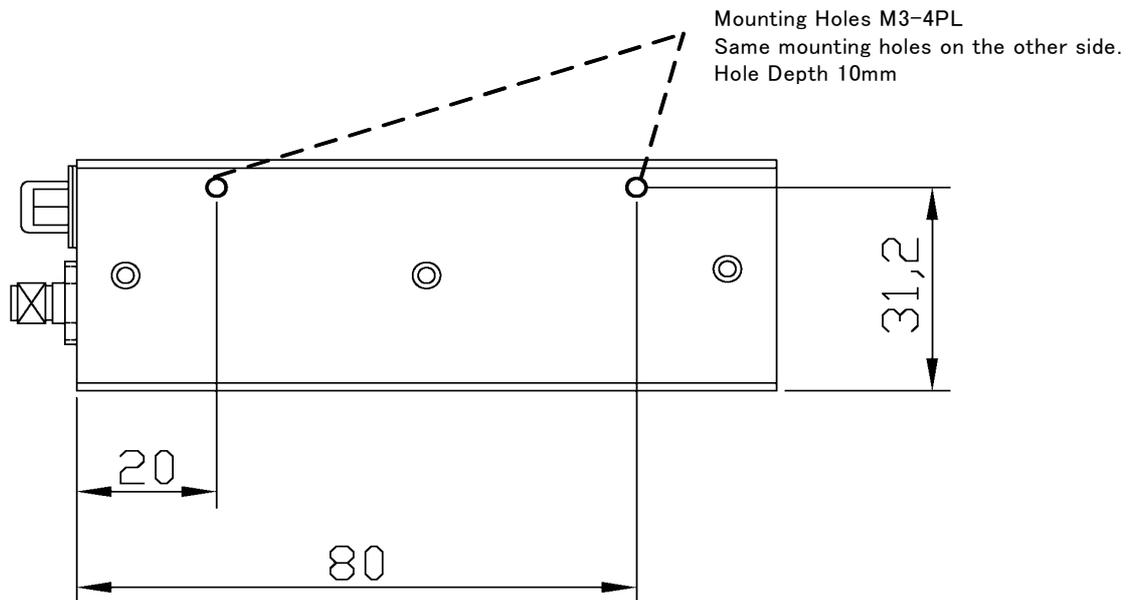
■ RS-232C port communication condition

Type of communication   Asynchronous serial data
Interface Level   RS-232C
Communication speed   9600BPS
Data length   8 bit
Stop bit   1 bit
Parity   none
Flow control   none

9 pin D-Sub pin assignment

Pin#		Signal name	Signal direction	Remarks
1		CD	DPL → terminal	Not used
	6	DSR	→	Connected to DTR internally
2		RD	→	
	7	RTS	←	Connected to CTS internally
3		TD	←	
	8	CTS	→	Connected to RTS internally
4		DTR	←	Connected to DSR internally
	9	RI	→	PLL unlocked signal
5		GND	←→	

Pin#9 is an open drain output and used as a PLL unlocked signal.
When PLL is locked : Low(Short to GND)
When PLL is unlocked : High(Open)

Please refer to the above table to set serial communication parameters of your terminal
software. Any communication software such as Hyperterminal can be used.

■   How to control
The following message is returned when DPL-3.2GXF is powered on.

```
DPL-3.2GXF    V1.0    Firm V1.0

MAIN MENU
    F_xx ——————————— Frequency SET
    A_xx ——————————— Output Level SET
    P_xx ——————————— Phase Offset SET
    ON ——————————— Output ON
    OFF ——————————— Output OFF
    SAVE ——————————— Frq&Level SAVE
    SUB ——————————— SUB MENU ENTRY
    STS ——————————— STATUS
    HELP ——————————— MAIN MENU CONTENTS



SYSTEM STATUS
    Frequency    = 1 234 567 890.123 [Hz]
    Output Level = 0.0 [dBm]
    Phase Offset = +0.0 [Deg]
    Output       = ON
    PLL LOCKED
    10MHz Base Clock Source = Internal
    External Clock Synchronize = OFF
*
```

This is just a example.
The status depends on how the unit is set

After the prompt "*" (2Ahex) is returned, commands can be entered. There are two
modes in command menu, main menu mode and sub menu mode.
Frequency and output level setting can be done in main menu mode. System setting
command such as setting 10MHz clock source can be done in sub menu mode. Enter
space code (20hex) after each command to set a value, then enter return key (0Dhex) as
a delimiter.

When ECHO BACK is set ON, entered codes are returned with return code (0Dhex)
and line feed code (0Ahex)
When ECHOBACK is set OFF, only "*" (2Ahex) is returned.

■ Main menu mode

```
MAIN MENU
    F_xx ————————————— Frequency SET
    A_xx ————————————— Output Level SET
    P_xx ————————————— Phase Offset SET
    ON ——————————————— Output ON
    OFF —————————————— Output OFF
    SAVE ————————————— Frq & Level SAVE
    SUB —————————————— SUB MENU ENTRY
    STS —————————————— STATUS
    HELP ————————————— MAIN MENU CONTENTS
```

1. F command   Frequency setting

The frequency setting has four formats, GHz unit input, MHz unit input, KHz unit input and Hz unit input. Add "G", "M", "K" after the setting value for distinguishing the unit. A GHz unit can be set maximum 12 digits following decimal point, and also, a MHz unit maximum 9 digits, a KHz unit maximum 6 digits, Hz unit maximum 3 digits. When DPL-3.2GF received the data correctly, it returns "*" (2Ahex) as a prompt which means the frequency setting is completed. When the data received incorrectly or some errors occurred during the transfer, "ERROR-", the type of error and "*" (2Ahex) code is returned. After that "*"(2Ahex)code is returned, then you can enter new command . This is the case ECHO BACK is set ON. When ECHO BACK is set OFF, "?"(3Fhex) is returned instead of "*" code. The message "ERROR-"and the type of error are not returned. Each time the frequency data is set continuously, be sure "*" (2Ahex) is returned after each command.

** Please note that even if the frequency of beyond the 3.2GHz was set, it would be accepted but the quality of the signal would not be guaranteed.

Here are some examples how to set frequencies.

How to set on GHz unit
        ** Please note that under score"_" means SPACE (20hex) and (CR) means
            return code (0Dhex).

        3.2GHz   **F_3.2G(CR)**
        1.234567890123GHz   **F_1.234567890123G(CR)**

How to set on MHz unit
    .
        100MHz   **F_100M(CR)**
        123.456789123MHz   **F_123.456789123M(CR)**

How to set on KHz unit

20,000KHz	**F_20000K(CR)**
123,456.789KHz	**F_123456.789K(CR)**

How to set on Hz unit

1,000,000,000.000Hz	**F_1000000000(CR)**
1,234,567,890.123Hz	**F_1234567890.123(CR)**

How to confirm the setting value
F(CR)   or   **F_?(CR)**

2. A command ------- Output level setting
Enter a desired output level, following A and space. The setting value can be set in dBm unit with decimal point. 0.1dB digit can be allowed but if omitted, it is assumed as 0. "+" (2Bhex) expression can be omitted but "-"(2Dhex) must be entered.
The revived data is correct the output level setting is completed, it returns "*" (2Ahex) code as a prompt. When the data received incorrectly or some errors occurred during the transfer, it is returned "ERROR-", the type of error and "*" code (in case ECHO BACK is set ON). When ECHO BACK is set OFF, only "?" is returned. Each time the output data is set continuously, make sure whether "*" (2Ahex) code is returned, and then set the new data.

** Please note that even if the output level of beyond the +14dBm was set , it would be accepted but the output level accuracy would not be guaranteed.

+10dBm	A_10(CR)
-0.5dBm	A_-0.5(CR)

How to confirm the setting value of output level data
A(CR)   or   A_?(CR)

3. P command ------- Phase Offset setting
Enter a desired phase offset value, following P and space. The setting value can be set in degree(°) unit with decimal point. 0.1degree digit can be allowed but if omitted, it is assumed as 0. "+" (2Bhex) expression can be omitted but "-"(2Dhex) must be entered.
The revived data is correct the phase offset setting is completed, it returns "*" (2Ahex) code as a prompt. When the data received incorrectly or some errors occurred during the transfer, it is returned "ERROR-", the type of error and "*" code (in case ECHO BACK is set ON). When ECHO BACK is set OFF, only "?" is returned. Each time the phase offset data is set continuously, make sure whether "*" (2Ahex) code is returned, and then set the new data.

[Example]

+90° P_90(CR)

-0.5° P_-0.5(CR)

How to confirm the setting value of phase offset data

P(CR) or P_?(CR)

[Example]

+45° +45.0[Deg]

4. ON command -------- output ON

Your setting frequency or output level will be output.

5. OFF command---------- output OFF

Output is shut off.

6.SAVE command-----to memorize the setting value

The current frequency and output level can be memorized.

IF this command is completed, "Done" and "*" were returned.

When the power is on next time, the stored data can be output.

7. SUB command ----- to select to the sub menu mode

Enter "EXIT(CR)" to back to main menu mode.

8. STS command------To get the current status

The current frequency, output level, phase offset, output status, power supply voltage, PLL status, 10MHz reference signal source will be returned.

For example,

```
        SYSTEM STATUS
                Frequency     = 1 234 567 890.123 [Hz]
                Output Level = 0.0 [dBm]
                Phase Offset = +0.0[Deg]
                Output       = ON
                System Power Voltage = 4.96 [V]
                PLL LOCK
                10MHz Standard Clock Source = Internal
                External Clock Synchronize = OFF
```

9. HELP command ------To get the menu help message.

The menu for all commands is displayed.

■   Sub menu mode for system setting

```
SUB MENU
   CSEL ─────────────── 10MHzClock Source Select
   CLK ──────────────── 10MHzClock Adjust
   ONOFF ────────────── Power on Output ON/OFF Set
   CS ───────────────── External Clock Synchronize ON/OFF set
   ECHO ─────────────── ECHO ON/OFF Set
   EXIT ─────────────── SUB MODE EXIT
   HELP ─────────────── SUB MENU CONTENTS

SUB*
```

Note: In this mode, "SUB*" is returned instead of "*".

1. CSEL command ----- Internal or external clock mode can be switched with this command.

```
10MHz_Standard_Clock_Source_Select

In case, Internal Clock Source ── put 'I' Key
In case, External Clock Source ── put 'E' Key
In case, Exit ───────────────── put 'X' Key
```

Note: The data input here will be memorized automatically.

2. CLK command -------To adjust the internal reference clock.
    1. First, confirm whether the current clock mode is internal mode with using STS command. If not, change to internal clock mode with CSEL command
    2. Connect the unit to a high resolution frequency counter and set a frequency.
    3. Enter "CLK" command, and the message is displayed as below.

```
Internal_10MHz_Standard_Clock_Adjust

'U''u'/ 'D''d' key ── Clock Adjust
'S' Key ── Save
'X' Key ── Exit
1840   (This number is just an example with no meanings)
```

Adjust the frequency by entering the following character till the frequency is given the right one on Frequency Counter.

"u" : To step the frequency up finely
"d" : To step the frequency down finely
"U" : To step the frequency up coarsely
"D" : To step the frequency down coarsely

4. Enter "S" for saving the setting value.
5. Enter "X" for exiting this CLK command.

3. ONOFF command-----To set output ON or OFF in case of setting the power on.

> **Power on Output State**
>
> In case, **Power on - Output ON ──** press '1' **Key**
> In case, **Power on - Output OFF ──** press '0' **Key**
> In case, **Exit ────────** press 'X' **Key**

        Note: This setting is memorized automatically.

4. CS command-------To set an external clock phase synchronous

> **External clock synchronize ON/OFF set**
>
> In case, **synchronize ON** ──────press '1' **key**
> In case **synchronize OFF** ──────press '0' **key**
> In case **Exit** ────────────press 'X' **key**

        Note: This setting is memorized automatically.

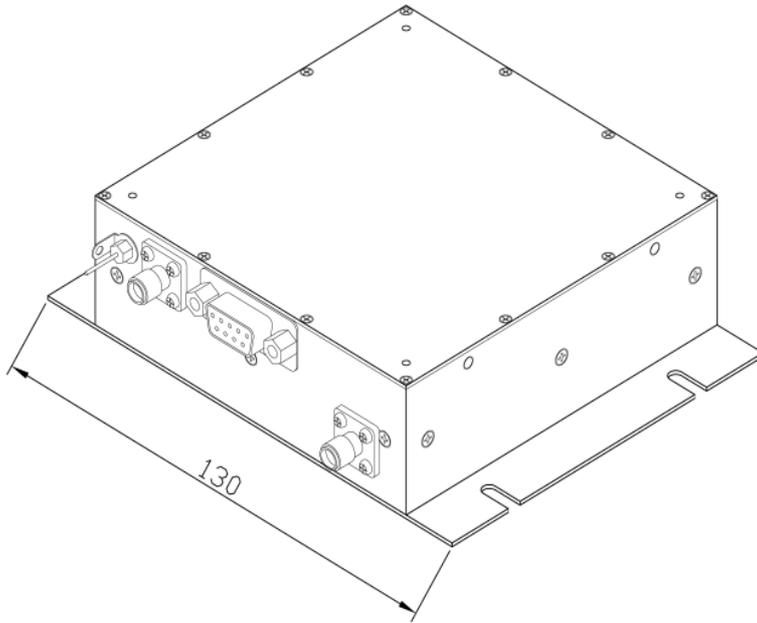5. ECHO command -------To set ECHO BACK

> **Echo Back ON/OFF set**
>
> **ECHO ON ──** press '1' **Key**
> **ECHO OFF ──** press '0' **Key**
> **Exit ───────**press 'X' **Key**

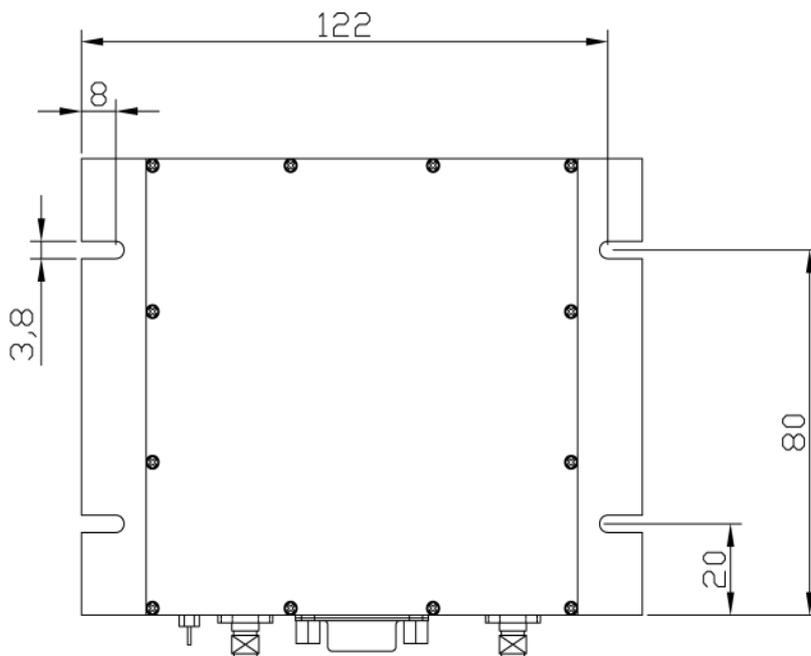   Note: This setting is memorized automatically.

6. EXIT command ------To end sub menu mode and return to Main mode.
7. HELP command ----- To get the sub mode menu help message.

■ Option -----Flange Type Case

Outline Dimension

130

Dimension of mounting holes

122

8

3,8

80

20

■ Cautions
1. Use the low noise power supply. When the switching power supply is used, use a noise filter to reduce switching noise from the power supply.

2. In external clock mode, use the external 10MHz clock having the frequency accuracy of less than +/-3ppm.

3. Pay attention airflow and thermal resistance when embedded to prevent not to raise temperature of the unit.

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