Multi-function High-precision Pulse Generator Manual

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Preface

Overview

The products that this document applies to are: Multi-function high-precision pulse generators.

This document describes the multi-function high-precision pulse generator to guide the user to use the multi-function high-precision pulse generator.

Object

This document is intended for the following engineers:

- Hardware engineer
- Test engineer

Introduction

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1 Product Overview

The multi-function high-precision pulse generator is a PWM pulse signal generator that can operate in pulse generator or SPWM generator. Working in pulse mode, double pulse, multi pulse or periodic pulse signal can be generated. Working in SPWM generator can simulate the PWM signal output of single-phase or three-phase inverter controller.
## 2 Technical parameters

### 2.1 Electrical parameters

#### Table-1 Electrical characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;OP&lt;/sub&gt;</td>
<td>AC supply</td>
<td>AC 100</td>
<td>220</td>
<td>AC 240</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>-</td>
<td>60</td>
<td>Hz</td>
</tr>
<tr>
<td>V&lt;sub&gt;o&lt;/sub&gt;</td>
<td>Output supply voltage</td>
<td>14.5</td>
<td>15.0&lt;sup&gt;[1]&lt;/sup&gt;</td>
<td>15.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.5</td>
<td>5.0&lt;sup&gt;[2]&lt;/sup&gt;</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>V&lt;sub&gt;PWM&lt;/sub&gt;</td>
<td>PWM signal output level&lt;sup&gt;[3]&lt;/sup&gt;</td>
<td>14.5</td>
<td>15</td>
<td>15.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>V&lt;sub&gt;1 (ERROR)&lt;/sub&gt;</td>
<td>Fiber input(ACCESS1, ACCESS1)&lt;sup&gt;[4]&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical input (ERROR 3~ ERROR 5)</td>
<td>-</td>
<td>3.3</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>T&lt;sub&gt;P MIN&lt;/sub&gt;</td>
<td>Minimum pulse width&lt;sup&gt;[5]&lt;/sup&gt;</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>us</td>
</tr>
<tr>
<td>T&lt;sub&gt;I MIN&lt;/sub&gt;</td>
<td>Minimum pulse interval</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>us</td>
</tr>
<tr>
<td>Value_input</td>
<td>Input valid range&lt;sup&gt;[6]&lt;/sup&gt;</td>
<td>0</td>
<td>-</td>
<td>6553.5</td>
<td>-</td>
</tr>
<tr>
<td>T&lt;sub&gt;OP&lt;/sub&gt;</td>
<td>Working temperature</td>
<td>-20</td>
<td>-</td>
<td>70</td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;STO&lt;/sub&gt;</td>
<td>Storage temperature</td>
<td>-40</td>
<td>-</td>
<td>85</td>
<td>°C</td>
</tr>
</tbody>
</table>

<sup>[1]</sup> The URNSUN power module URB2405D-10WR2 is used internally to provide a maximum 5V/2A power output.

<sup>[2]</sup> The power module URB2405D-10WR2 inside the device using MORNSUN provides a maximum 5V/2A power output.

<sup>[3]</sup> The device provides 15V and 5V CMOS logic level signal outputs. There are 5V-CMOS and 15V-CMOS logos on the terminals. It is worth noting that a 1/8W 10Ω current limiting resistor is connected in series with the output signal path to prevent accidental burnout of the internal driver circuit.

<sup>[4]</sup> The device allows external fault signal input and provides both optical and electrical signal interfaces. The optical signal is received by HFBR-2521Z, which is normal when there is light, and is faulty when there is no light; electrical signal input, low level (<1.0V) represents fault, and high level (>2.0 V) represents normal. Note that the allowable input high level cannot be greater than 15V. By default, the device blocks these fault signals, that is, the input is invalid. If you need it, you can unmask it. When it is normal, the device can output the signal normally, and the pulse will be blocked when the fault occurs.
[5] The minimum pulse unit supported by the device is us, the minimum step size is 0.1, the minimum pulse width can be 0.1us; if you switch the time unit to ms, the minimum pulse width is 0.1ms; if you switch the time unit for s, the minimum pulse width is 0.1 s;

[6] The value input box of the device UI interface supports input of values from 0 to 6553.5. If the range is exceeded, an error will be reported.

### 2.2 Interface Definition

The multi-function high-precision pulse generator only needs one AC power supply. It is recommended to use AC220V/50Hz power supply, and its interface is the word power interface. The input and output interfaces include two types of interfaces: an optical signal interface and an electrical signal interface. The interface location is shown in Figure-1.

![Figure-1 Generator Interface](image)

The device provides users with 15V/2A and 5V/2A DC power output. The total output power of the 15V power supply must not exceed 30W, and the total output power of the 5V power supply must not exceed 10W. The connector is a board-to-wire connector with a pin pitch of 3.5mm. Pin count: 1*13Pin. Model:MC1.5/13-G-3.5-1844320（PHOENIX CONTACT）.See Figure 2 or Figure-2 for the definition and description of each connector.

### Table-2  Power Interface Definition and Description

<table>
<thead>
<tr>
<th>Num</th>
<th>Symbol</th>
<th>Description</th>
<th>Num</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+15V</td>
<td>15V power output</td>
<td>8</td>
<td>PWM1</td>
<td>PWM1 signal output</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
<td>9</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>+5V</td>
<td>5V power output</td>
<td>10</td>
<td>PWM4</td>
<td>PWM4 signal output[1]</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
<td>11</td>
<td>PWM3</td>
<td>PWM3 signal output</td>
</tr>
<tr>
<td>5</td>
<td>PWM4</td>
<td>PWM4 signal output[1]</td>
<td>12</td>
<td>PWM2</td>
<td>PWM2 signal output</td>
</tr>
<tr>
<td>6</td>
<td>PWM3</td>
<td>PWM3 signal output</td>
<td>13</td>
<td>PWM1</td>
<td>PWM1 signal output</td>
</tr>
<tr>
<td>7</td>
<td>PWM2</td>
<td>PWM2 signal output</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
[1] This part is a 5V logic signal output, the silk screen is marked as 5V-CMOS, this interface only supports four output from PWM1 to PWM4.

[2] This part is a 15V logic signal output, the screen printing is labeled 15V-CMOS, this interface only supports four output from PWM1 to PWM4.

Figure-2 Power supply interface

The device can provide users with four PWM optical signals and two fault feedback. The optical signal and the electrical signal output synchronously, and the user does not need to make any configuration. The fiber optic transmitter and receiver use Broadcom's HFBR-1521Z and HFBR-2521Z. The definition and description of each interface are shown in Table-3.

Table-3 Optical Signal Interface Definition and Description

<table>
<thead>
<tr>
<th>Num</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ERROR1</td>
<td>ERROR 1 input</td>
</tr>
<tr>
<td>2</td>
<td>ERROR2</td>
<td>ERROR 2 input</td>
</tr>
<tr>
<td>3</td>
<td>PWM1</td>
<td>PWM1 signal output</td>
</tr>
<tr>
<td>4</td>
<td>PWM2</td>
<td>PWM2 signal output</td>
</tr>
<tr>
<td>5</td>
<td>PWM3</td>
<td>PWM3 signal output</td>
</tr>
<tr>
<td>6</td>
<td>PWM4</td>
<td>PWM4 signal output</td>
</tr>
</tbody>
</table>

[1] This part is the external fault input. The factory default masks this signal. The interface supports two inputs of ERROR1 and ERROR2.

[2] This part is the optical signal output. When the output is high, the fiber is bright. When the output is low, the fiber is off, and the output is synchronized with the electrical signal.

The device's electrical signal interface provides the user with a power output and a PWM signal output. The interface is 2*25Pin horn connector, 2.54mm pin pitch, electrical signal and optical signal synchronous output, no need to do any configuration. Model:R-230-011-850-209 (NEXTRON). See Table-4 or Figure-4 for the definition and description of the connector's interface.

Table-4 Interface Definition and Description
This part is a 15V logic signal output, the screen printing is labeled 15V-CMOS, this interface holds PWM1–PWM6 output.

This part is an external fault input. The factory default masks this signal. The interface supports three inputs from ERROR3 to ERROR5.

This part is a 5V logic signal output, the silk screen is marked as 5V-CMOS, this interface supports six output from PWM1 to PWM6.
3 Functional Description

This device is called a multi-function high-precision pulse generator and is an auxiliary tool for IGBT drive high voltage test. The single pulse signal, double pulse signal, multi pulse, periodic signal or SPWM signal can be accurately issued according to the needs of the user.

Double pulse signal: two consecutive pulses can be sent at a time, output to the IGBT driver, generally for double pulse test;

Single pulse signal: A single high level pulse can be issued at one time and output to the IGBT driver, which can generally be used for short circuit test;

Multi-pulse signal: Up to six pulses can be emitted at a time.

Periodic pulse signal: A pulse signal of a certain period can be issued for detecting the working state of the driver or continuous power test;

SPWM signal: SPWM signal can be sent to simulate the output of single-phase or three-phase inverter controller (only for two levels), used to detect the operating state of the driver or continuous power test.

4 Steps for usage

The following steps explain how to use the device correctly.
4.1 Connect the power cord

Connect the power cable to the power connector of the device and the other end to the AC power socket. The input voltage can be AC100V~240V (50Hz/60Hz). It is recommended to use 220V/50Hz.

4.2 Connecting signal line

Connect the signal output port of the device to the signal input port of the drive as needed.

Note: If using an electrical signal interface, please note that the signal logic levels match.

4.3 Power check

Check that the wiring is correct. After confirming that there is no error, turn on the power switch of the device and wait for the device to start. The COM communication indicator flashes (yellow light), the display shows the human-computer interaction interface, and the system runs normally.

4.4 Operation Interface

After starting the device, enter the HMI interface. The HMI displays four modes: double pulse, multiple pulse, periodic pulse and SPWM pulse.

![PWM Signal Generator]

Choose the right working mode based on your needs. Click “Double Pulse” to enter the double pulse generator; click “Multiple Pulse” to enter the multiple pulse generator; click “Periodic Pulse” to enter the periodic pulse generator; click “SPWM Pulse” to enter the SPWM pulse generator.

4.4.1 Double Pulse Generator
The double pulse generator can be used to generate a double pulse or single pulse signal. One of the PWM1, PWM2, PWM3, PWM4, PWM5, and PWM6 channels can be selected as the signal output channel. Generally used for double pulse test or short circuit test. The setup process is shown in Figure -6.

Figure-6 Double Pulse Generator

1. Output Channel:
   Pulse_CH, you can select the output channel that sends the pulse signal.
   High level CH, select the channel that outputs the long high signal. This channel is usually used when doing the through short circuit test.

2. Pulse width: used to set the time of this pulse output high or low, the minimum unit is 0.1us.

3. Generate: Click once and the signal generator sends a pulse. If the high level channel is selected, the high level channel will also output a high level while the pulse channel is pulsed, and the pulse is in the left figure.

   Pulse_CH: T1 → T2 → T3 →  
   High level CH: 

   Pulse_CH: T1 →  
   High level CH: 

   Note: When T2 and T3 are set to zero “0”, a single pulse can be issued, as shown in the right figure.

4. ? : Help description, provide instructions for use in this generator.

5. (us) : Time unit, switch the pulse width unit, click to switch between three time units: “us”, “ms” and “s”.

6. Return: Return to the main interface.
Note: All manual operations on high pressure can be life-threatening and must comply with the relevant safety regulations.

4.4.2 Multiple pulse Generator

The multiple pulse generator can be used to generate multiple pulse signals, and one of the PWM1, PWM2, PWM3, PWM4, PWM5, and PWM6 can be selected as the signal output channel. The setup process is shown in Figure -7.

1. Output Channel:

Pulse_CH, you can select the output channel that sends the pulse signal.

High level CH, select the channel that outputs the long high signal. This port is usually used when doing the through short circuit test.

2. Pulse width: used to set the time of this pulse output high or low, the minimum unit is 0.1us.

3. Generate: Click once and the generator sends a pulse. If the long high port is selected, the high level channel will also output a high level while the pulse channel is pulsed, and the pulse is as follows.

4. Help description, provide instructions for use in this generator.
5. **us**: Time unit, switch the pulse width unit, click to switch between three time units: “us”, “ms” and “s”.

6. Return: Return to the main interface.

**Note**: All manual operations on high pressure can be life-threatening and must comply with the relevant safety regulations.

### 4.4.3 Periodic Pulse Generator

The periodic pulse generator can be used to issue a periodic pulse signal, and one of the PWM1, PWM2, PWM3, PWM4, PWM5, and PWM6 can be selected as the signal output channel. Generally used in continuous pulse test. The setup process is shown in Figure -8.

![Periodic Pulse Gen](image)

**Figure -8 Periodic Pulse Generator**

1. **Output Channel**:

   Pulse_CH, you can select the output channel that sends the pulse signal.

   High level CH, select the channel that outputs the long high signal. This port is usually used when doing the through short circuit test.

2. **Pulse width**: used to set the time of this pulse output high or low, the minimum unit is 0.1us.

3. **Generate**: Click once and the generator emits a periodic pulse.
Note: The period $T$ time must be greater than the high time to issue a periodic signal, otherwise only a single pulse will be emitted.

4. Stop Gen: Click once, the generator stops issuing periodic pulses.

5. ? Help description, provide instructions for use in this generator.

6. (us): time unit, switch pulse width unit, click to switch between "us", "ms" and "s" three time units.

7. Return: Return to the main interface.

Note: All manual operations on high pressure can be life-threatening and must comply with the relevant safety regulations.

4.4.4 SPWM Generator

The SPWM generator is used to simulate the output of a single-phase or three-phase inverter controller. In single-phase mode, PWM1 and PWM2 channels are complementary signals, PWM2 and PWM4 channels are complementary signals. In the three-phase mode, the PWM1 channel corresponds to the A-phase upper arm, the PWM2 channel corresponds to the A-phase lower arm, the PWM3 channel corresponds to the B-phase upper arm, the PWM4 channel corresponds to the B-phase lower arm, and the PWM5 channel corresponds to the C-phase upper arm. The PWM6 channel corresponds to the C-phase lower arm.

![Single phase inverter](image1)

![Three-phase inverter](image2)

**Figure-9 SPWM output signal corresponding topology**
In the main interface, click “SPWM Pulse” to enter the SPWM pulse generator, and then set the carrier frequency and fundamental frequency and amplitude. Input the carrier frequency first, then input the fundamental frequency and its amplitude (the fundamental frequency setting). The range is 0~5kHz, and the carrier frequency setting range is 1~50kHz). The working mode can be single-phase output or three-phase output. The setting process is as shown in Figure-10:

1. Fundamental frequency: Set the frequency of the fundamental wave in Hz.
2. Carrier frequency: Set the carrier frequency in kHz.
3. Fundamental amplitude: Set the amplitude of the fundamental wave in %.
4. Dead time: Set the dead time of the upper and lower bridge signals, the unit us.
5. Working mode selection: single phase output or three phase output.
6. Generate: Click to perform pulse output.
7. Stop Gen: Click to stop the pulse output.
8. Help instructions, provide instructions for use in this mode.
9. Return: Click to return to the main interface.

Note: All manual operations on high pressure can be life-threatening and must comply with the relevant safety regulations.

4.5 Advanced Settings
Click “ ” on the main interface to enter the setting interface, where you can set the output port, system language, reset the device, enable or disable the fault signal, as shown in Figure-11:

![Output Port settings](image)

**Figure-11 Output Settings**

- **Inverting Output**: The inverting output is equivalent to adding an inverter to the output signal. The default is “Disabled”. When an inverse logic output is required, the inverting output can be “enabled” and a channel can be inverted separately.

- **Language**: Switch the language of the operation interface. Click to switch between Chinese and English.

- **Time Unit**: The time unit for switching the pulse width. Click to switch between “us” “ms” and "s".

- **Optical signal failure**: Here to switch whether to shield the optical signal failure. The default is to mask the fault, and the device will not respond even if the fiber has a fault signal input. Click to switch between “Invalid” and “Valid”. If it is valid, the device will forcibly stop the blocking pulse when the fiber has a fault signal input.

- **Electric signal failure**: Here to switch whether to shield the electrical signal failure. The default is to mask the fault. At this time, the device does not respond even if the electrical signal interface has a fault signal input. Click to switch between “Invalid” and “Valid”. If it is valid, the device forcibly stops the blocking pulse when the electrical signal interface has a fault signal input.

- **Reset All**: This is used to reset the device to its default value, which can be clicked when the device is abnormal or if you want to reset it quickly.

### 5 Mechanical dimensions
The external dimensions of the device are 235.0 mm x 183.0 mm and the height is 122.0 mm.