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# DIGITAL I/O FUNCTION FOR R&S®NGP804

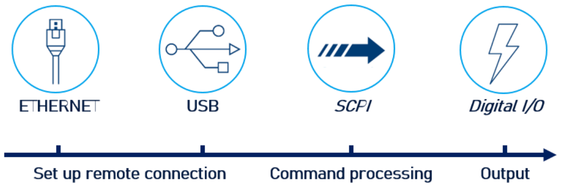
## SCPI and python cheat sheet

## Digital I/O with NGP®804

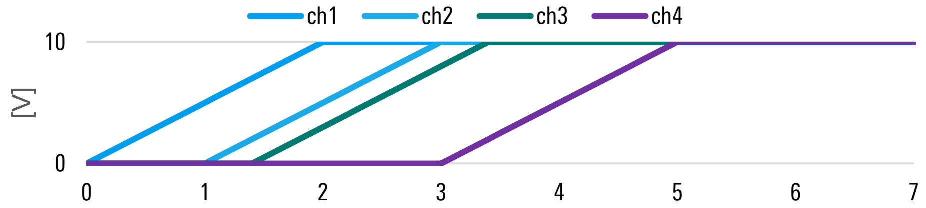
### Steps

1. Set up the remote connection via **LAN**, **USB** or **GPIB**
2. Use **SCPI** commands to set up the digital I/O function
3. Connect your **DUT**

### Process



## Sample graph for triggered ramp function



- ▶ DIO1 (pin 12) is configured as output with condition VLevel=5V (red marker)
- ▶ DIO2 (pin 4) is configured as input to enable channel 2
- ▶ The same is done for channel 3 and 4. DIO3 (pin 11) and DIO5 (pin 10) as output and DIO4 (pin 3) and DIO6 (pin 2) as input, for channel 3 and 4.
- ▶ For channel 3, VLevel=2V (orange marker) and for channel 4, VLevel=8V (black marker) is chosen.

## Ramp & Digital I/O SCPI commands for the example

| | |
|---|---|
| >>> INST X | #select the output X of your device |
| >>> APPL 10.0, 1.0 | #voltage 10V, current 1A |
| >>> VOLT:RAMP:DUR Y | #ramp duration Y |
| >>> VOLT:RAMP ON | #enables the ramp function |
| >>> OUTP:GEN ON | #enables output for selected channel |
| >>> TRIG:SEL:DIOX ON | #switch trigger at pin X on |
| >>> TRIG:DIR:DIOX (OUTP/IN) | #select the behavior of digital I/O |
| >>> TRIG:CHAN:DIOX CHX | #select the channel X to be triggered |
| >>> TRIG:COND:DIOX VLEV,voltage | #select the voltage level of the trigger |
| >>> TRIG:LOG:DIOX HIGH/ENAB | #select the logic level of the trigger |

## Library for connection to the power supply

The RsInstrument library provides a connection between python and the power supply.

| Steps | Command |
|---|---|
| Use the following pip convention to install this package: | pip install RsInstrument |
| After installing the package, use the following import convention: | from RsInstrument import*<br>from time import sleep |

## Set up connection to your device:

```
RsInstrument.assert_minimum_version('1.10.0') #set a minimum version
ngp = RsInstrument('TCPIP::xxx.xxx.xxx.xxx::INSTR', True, True, "SelectVisa= 'rs', '')
#Standard LAN connection/ Control the device via RsVisa
```

## Set up ramp function:

```
def ramp_setup(channel):
    ngp.write_str(f'INST {channel}') #choose channel
    ngp.write_str(f'APPL 10.0,1.0') #set voltage and current
    ngp.write_str(f'VOLT:RAMP:DUR 2') #set the duration of the ramp
    ngp.write_str("VOLT:RAMP ON") #activate ramp function
```

## Set up trigger:

```
def trig_setting(Pin, channel, voltage, behavior):
    ngp.write(f'TRIG:SEL:DIO{Pin} ON’) #switch the trigger at Pin X on
    ngp.write(f'TRIG:DIR:DIO{Pin} {behavior}’) #select the behavior of the digital I/O
    ngp.write(f'TRIG:CHAN:DIO{Pin} CH{channel}’) #select the channel X to be triggered
    if behavior == 'INP':
        ngp.write(f'TRIG:COND:DIO{Pin} ENAB’) #switch on the trigger at Pin X
    else:
        ngp.write(f'TRIG:COND:DIO{Pin} VLEV,{voltage}’) #select the voltage level of the trigger
    ngp.write(f'TRIG:LOG:DIO{Pin} HIGH’) ##switch on the trigger at Pin X
```

## Start output:

```
def dio_start():
    ngp.write('TRIG:GEN ON')
    ngp.write('INST 1')
    ngp.write('OUTP ON')
```

## Stop ramp function:

```
def off():
    state = 1
    while state == 1: # wait until CH1 changes to OFF state, then switch off main output
        sleep(0.4)
        state = ngp.query_int('OUTPut:GEN?')  # Request output state
    ngp.write('OUTPut:GENeral:STATe OFF')  # Switch off Main Output
    ngp.close()  # Close the connection finally
```

## Call functions:

```
if __name__ == "__main__":
    Pin_out, Pin_in, VLev, Channels = [1,3,5], [2,4,6], [5.0,2.0,8.0], [1,2,3,4]
    for i in range(0,len(Pin_out)):
        ramp_setup(Channels[i])  # call dio_setup for each list item
        trig_setting(Pin_out[i],Channels[i],VLev[i], "OUTP")
        trig_setting(Pin_in[i],Channels[i+1],0, "INP")
    dio_start()  # finally start the output
    off()
```

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Firmware Version: 02.015