slave
7-bit address   b1101OOX   X=0   ADO=0   The significance
         ✗   X=1   ADO=1   of this is that
0x68   binary   it allows
                    $\underline{0110\,1000}$ using two
0x6B   6   8   identical sensors on
                               the same I2C bus
                               without address
                                    conflict

ADtw   1101000$\underline{0}$ - write
RA   0x6B
DATA   0x00

<u>0x19</u>   SMPLRT_DIV Register

$$\text{Sample Rate} = \frac{\text{Gyroscope Output Rate}}{1 + \text{SMPLRT\_DIV}}$$

Default gyroscope o/p rate = 8KHZ   DLPF_CFG = 0
                              1KHZ   DLPF_CFG ≥ 1

Basic motion detection   100-200 Hz   79-100Hz
Gesture recognition   200-500HZ
Balancing robots/drones   500-1000Hz
High-speed motion capture   >1000Hz

Sample Rate → The no. of times per second the sensor collects
              data is called the sample Rate (unit = Hz)

0x1A CONFIG

DLPF_CFG [2:0]

Digital Low Pass Filter DLPF

0x1B GYRO_CONFIG

FS_SEL [1:0]

		degree/sec	sensitivity
slow	0	±250 °/s	131
Medium	1	±500	65.5
fast	2	±1000	32.8
very fast	3	±2000	16.4

0 → Hand gesture detection

1 → Smartphone tilting

Drone flight ±1000 -2000°/s

Fast rotations ±2000°/s

0x1C ACCEL_CONFIG

AFS_SEL [1:0]

$1g = 9.81 \, m/s^2$

0	±2g →	small movements, tilts or slow walking
1	±4g	moderate motion, like running or rotating faster
2	±8g	
3	±16g →	fast motion or impacts — like dropping the device

0 → ±2g   16-bit signed integer

$-32768 \text{ to } +32767$

$1g = 16384 \text{ counts}$

Temperature in degrees C = (TEMP_OUT Register Value as
a signed quantity)/340 + 36.53

•Bandwidth → how much signal freq. the sensor can pass
through the internal filter.
high bandwidth → more high freq data (including noise)
to pass
low bandwidth → only slow-changing (low-freq)
signals and filters out noise.

Analogy - Think of a water pipe.
wide pipe (high bandwidth) allows everything through
- both clean water and dirt
narrow pipe (low bandwidth) filters out dirt but slows
down water flow

• Delay - time the sensor takes to respond to a change
High bandwidth = fast response (low delay)
Low bandwidth = slow response (high delay)

Speed-sensitive ? → Go for low delay/high bandwidth
Stability-sensitive ? → Go for high delay/low bandwidth