Robotics

Digital input / Serial communication

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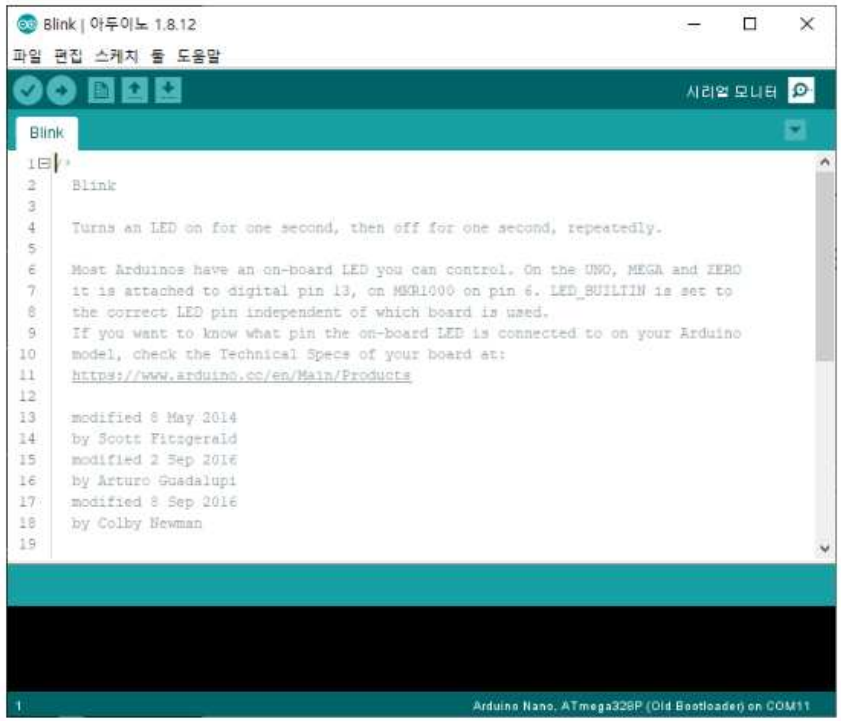
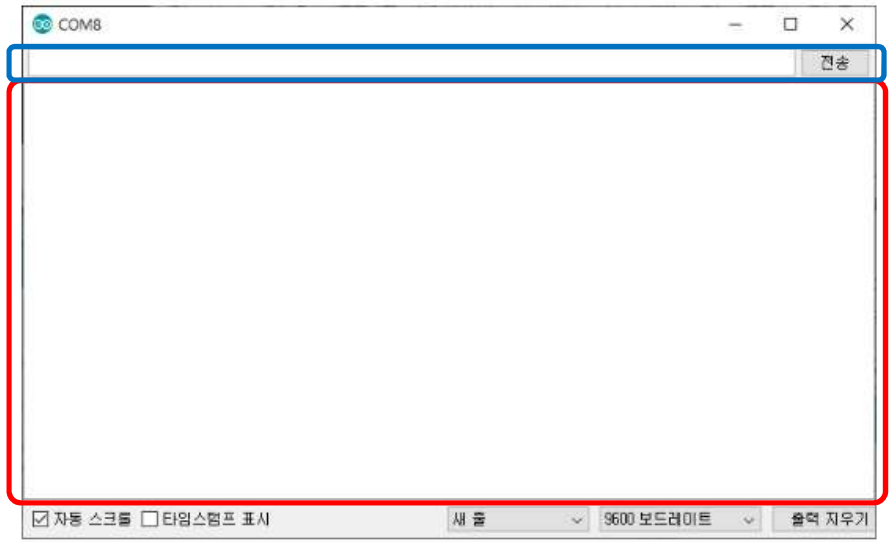
Basics

● Serial monitor

○ Arduino environment is embedded with the built-in serial monitor to communicate with an Arduino board.



아두이노 IDE 프로그램



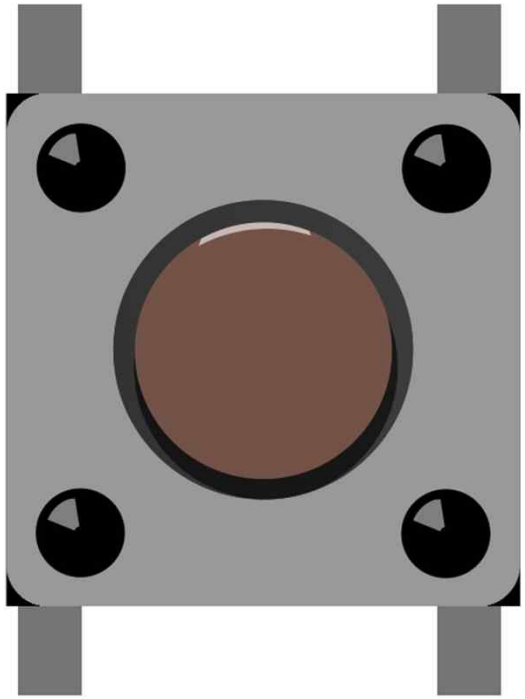
시리얼모니터 창

Basics

●Tinkercad

Basics

- **Push button (Switch)**
  - The pushbutton is a component that connects two points in a circuit when you press it.



Functions

- **Serial.begin()**
  - Sets the data rate in bits per second for serial data transmission
  - Syntax
    - Serial.begin(speed)
      - Speed : 300, 600, 1200, 2400, 4800, **9600**, 14400, 19200, 28800, 38400, 57600, or 115200
  - Example

```
void setup() {
  Serial.begin(9600); // opens serial port, sets data rate to 9600 bps
}
```

Functions [cont'd]

- **Serial.print()**
  - Prints data to the serial port as human-readable ASCII text
  - Syntax
    - Serial.print(val)
    - Serial.print(val, format)
      - val: the value to print - any data type
      - format: specifies the number base (for integral data types) or number of decimal places (for floating point types)

Functions [cont'd]

- Example

  Serial.print(78) gives "78"

  Serial.print(1.23456) gives "1.23"

  Serial.print("N") gives "N"

  Serial.print("Hello world.") gives "Hello world."

  Serial.print(78, BIN) gives "1001110"

  Serial.print(78, OCT) gives "116"

  Serial.print(78, DEC) gives "78"

  Serial.print(78, HEX) gives "4E"

  Serial.println(1.23456, 0) gives "1"

  Serial.println(1.23456, 2) gives "1.23"

  Serial.println(1.23456, 4) gives "1.2345"

ASCII Code

Dec	Hx	Oct	Char	Dec	Hx	Oct	Char	Dec	Hx	Oct	Char	Dec	Hx	Oct	Char
0	0	000	NUL (null)	32	20	040	Space	64	40	100	@	96	60	140	`
1	1	001	SOH (start of heading)	33	21	041	!	65	41	101	A	97	61	141	a
2	2	002	STX (start of text)	34	22	042	"	66	42	102	B	98	62	142	b
3	3	003	ETX (end of text)	35	23	043	#	67	43	103	C	99	63	143	c
4	4	004	EOT (end of transmission)	36	24	044	$	68	44	104	D	100	64	144	d
5	5	005	ENQ (enquiry)	37	25	045	%	69	45	105	E	101	65	145	e
6	6	006	ACK (acknowledge)	38	26	046	&	70	46	106	F	102	66	146	f
7	7	007	BEL (bell)	39	27	047	'	71	47	107	G	103	67	147	g
8	8	010	BS (backspace)	40	28	050	(	72	48	110	H	104	68	150	h
9	9	011	TAB (horizontal tab)	41	29	051	)	73	49	111	I	105	69	151	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	74	4A	112	J	106	6A	152	j
11	B	013	VT (vertical tab)	43	2B	053	+	75	4B	113	K	107	6B	153	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	76	4C	114	L	108	6C	154	l
13	D	015	CR (carriage return)	45	2D	055	-	77	4D	115	M	109	6D	155	m
14	E	016	SO (shift out)	46	2E	056	.	78	4E	116	N	110	6E	156	n
15	F	017	SI (shift in)	47	2F	057	/	79	4F	117	O	111	6F	157	o
16	10	020	DLE (data link escape)	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1 (device control 1)	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2 (device control 2)	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3 (device control 3)	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4 (device control 4)	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN (synchronous idle)	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB (end of trans. block)	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN (cancel)	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM (end of medium)	57	39	071	9	89	59	131	Y	121	79	171	y
26	1A	032	SUB (substitute)	58	3A	072	:	90	5A	132	Z	122	7A	172	z
27	1B	033	ESC (escape)	59	3B	073	;	91	5B	133	[	123	7B	173	{
28	1C	034	FS (file separator)	60	3C	074	<	92	5C	134	\	124	7C	174	|
29	1D	035	GS (group separator)	61	3D	075	=	93	5D	135	]	125	7D	175	}
30	1E	036	RS (record separator)	62	3E	076	>	94	5E	136	^	126	7E	176	~
31	1F	037	US (unit separator)	63	3F	077	?	95	5F	137	_	127	7F	177	DEL

128 Ç	161 í	193 ⊥	225 ß
129 ü	162 ó	194 ┬	226 Γ
130 é	163 ú	195 ├	227 π
131 â	164 ñ	196 ─	228 Σ
132 ä	165 Ñ	197 ┼	229 σ
133 à	166 ª	198 ╞	230 µ
134 å	167 º	199 ╟	231 τ
135 ç	168 ¿	200 ╚	232 Φ
136 ê	169 ⌐	201 ╔	233 Θ
137 ë	170 ¬	202 ╩	234 Ω
138 è	171 ½	203 ╦	235 δ
139 ï	172 ¼	204 ╠	236 ∞
140 î	173 ¡	205 ═	237 φ
141 ì	174 «	206 ╬	238 ε
142 Ä	175 »	207 ╧	239 ∩
143 Å	176 ░	208 ╨	240 ≡
144 É	177 ▒	209 ╤	241 ±
145 æ	178 ▓	210 ╥	242 ≥
146 Æ	179 │	211 ╙	243 ≤
147 ô	180 ┤	212 ╘	244 ⌠
148 ö	181 ╡	213 ╒	245 ⌡
149 ò	182 ╢	214 ╓	246 ÷
150 û	183 ╖	215 ╫	247 ≈
151 ù	184 ╕	216 ╪	248 °
152 ÿ	185 ╣	217 ┘	249 ∙
153 Ö	186 ║	218 ┌	250 ·
154 Ü	187 ╗	219 ■	251 √
156 £	188 ╝	220 ▄	252 ⁿ
157 ¥	189 ╜	221 ▌	253 ²
158 ₧	190 ╛	222 ▐	254 ■
159 ƒ	191 ┐	223 ▀	255
160 á	192 └	224 α	

Functions [cont'd]

- **Serial.write()**
  - Writes binary data to the serial port. This data is sent as a byte or series of bytes
  - Syntax
    - Serial.write(val)
    - val: a value to send as a single byte
  - Example

```
void setup() {
    Serial.begin(9600);
}
void loop() {
  Serial.write(49);      // send a byte “1” with the value 49
 }
```

Functions [cont'd]

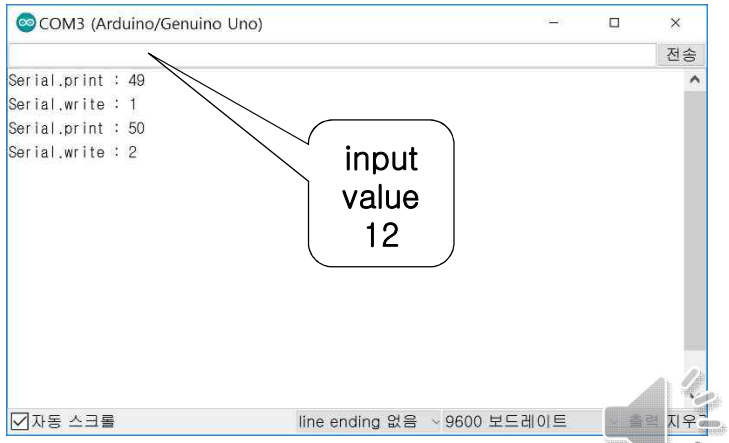
- **Serial.available()**
  - Get the number of bytes (characters) available for reading from the serial port
  - Syntax
    - Serial.available()
  - Example

```
void setup() {
    Serial.begin(9600);
}
void loop() {
  if(Serial.available()>0){          // send data only when you receive data
            Serial.print("I received");
}}
```

Functions [cont'd]

- **Serial.read()**
  - Reads incoming serial data Syntax
  - Syntax
    - Serial.read()
  - Example

```
void loop() {
  if(Serial.available()>0){          // send data only when you receive data
        int incomingByte=Serial.read();   // read the incoming byte
        Serial.print("Serial.print : ");        //
        Serial.println(incomingByte);
        Serial.print("Serial.write : ");
        Serial.write(incomingByte);
}}
```

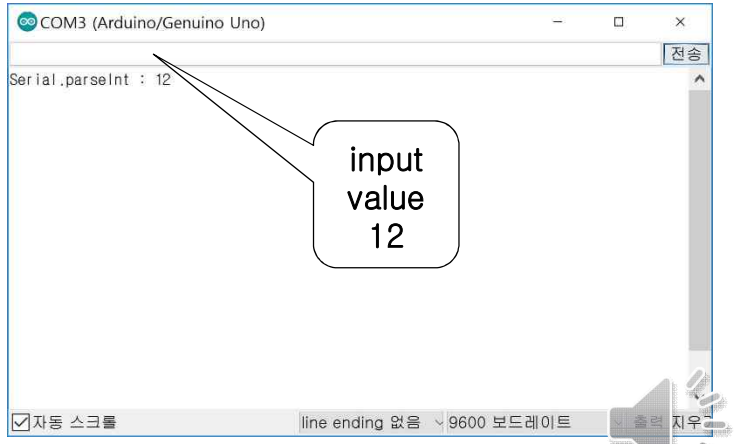


Functions [cont'd]

Serial.parseInt()

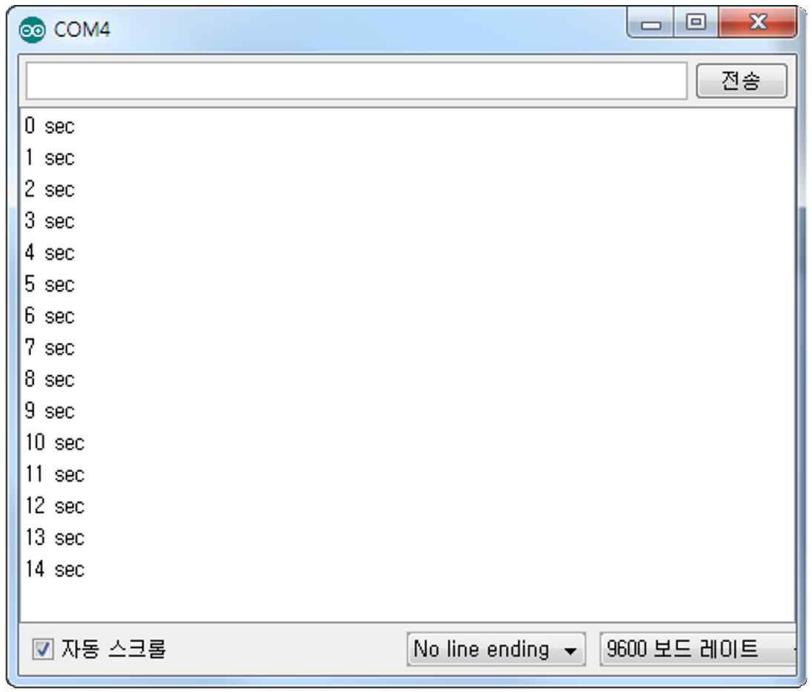
- This function returns the first valid (long) integer number from the serial buffer. Characters that are not integers (or the minus sign) are skipped.
- Syntax
  - Serial.parseInt()
- Example

```
void loop() {
  if(Serial.available()>0){          // send data only when you receive data
        int par=Serial.parseInt();
        Serial.print("Serial.parseInt : ");
        Serial.println(par);
}}
```



Lab. 1 - Counter

- **Use the built-in serial monitor to communicate with an Arduino board.**
  - Click the serial monitor button in the toolbar



Lab. 1 - Counter [cont'd]

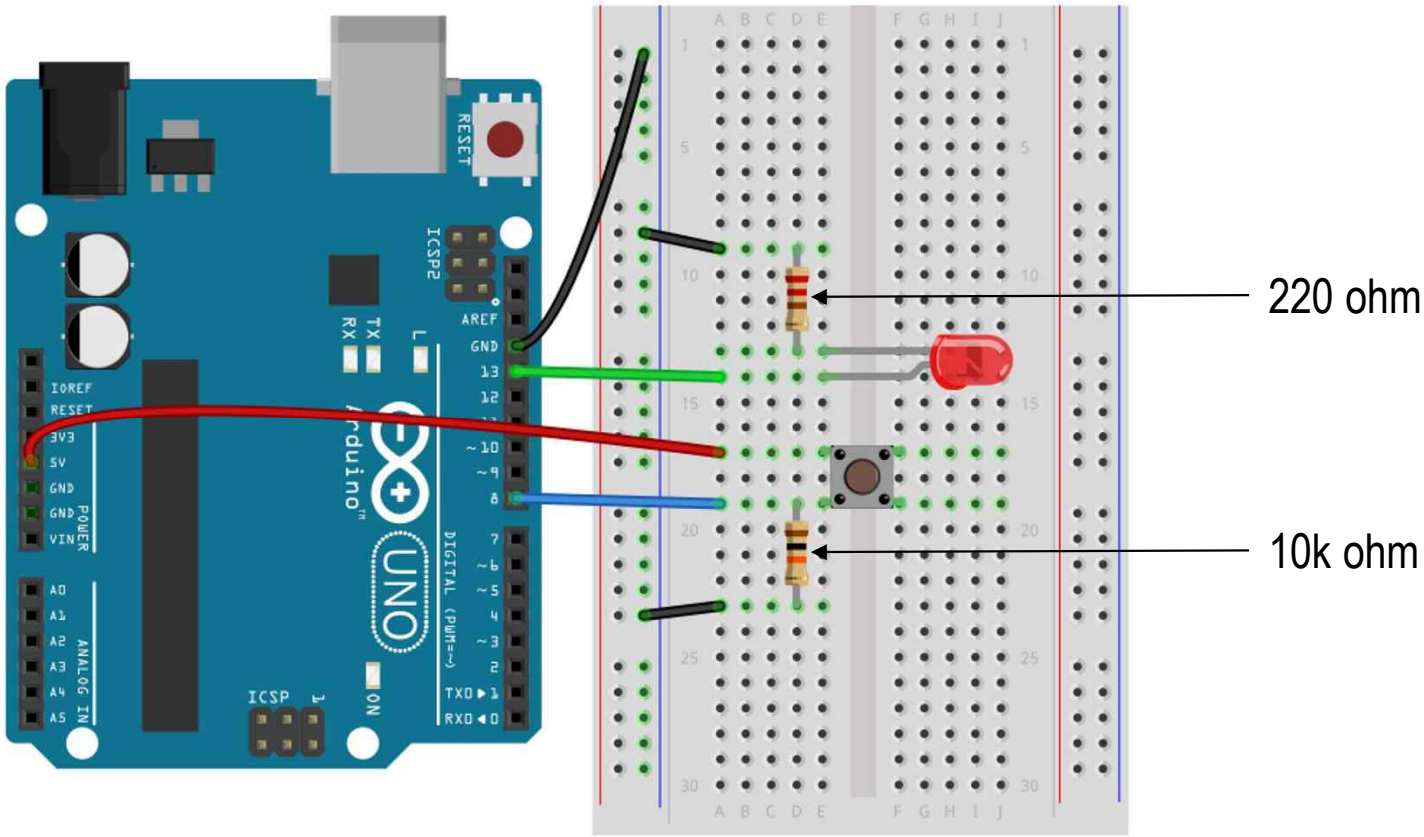
- **Write a program to send increasing integer value to the board**
  - Initialize serial port with baud rate 9600
    - Serial.begin(9600); (in setup function)
  - Send the counter value to the board for every 1sec
    - Serial.println(count);
    - delay(1000);
  - How to know the received number?
    - Click “Serial monitor” (magnifier icon)

Lab. 2 - PushButton 1

- **Write a sketch to turn on a LED when push button is pressed**
  - Setup I/O pins
    - e.g. pinMode(13, OUTPUT); pinMode(8, INPUT);
  - Read the status of the push button
    - buttonState = digitalRead(8); // return HIGH or LOW
  - Set DPin13 as HIGH when the push button is pressed

Lab. 2 - PushButton 1 [cont'd]

- Circuit diagram:

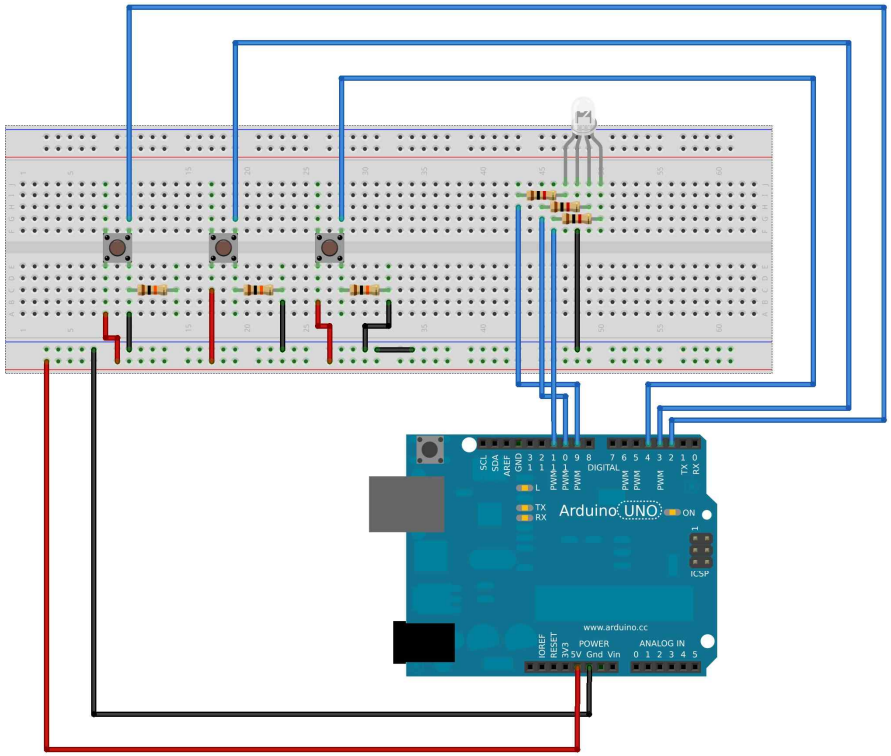


Lab. 3 - Counter+PushButton 1

- **Write a program to send increasing integer value to the board**
  - When the push buttons are pressed, initialize the counter to zero

Lab. 4 - PushButton 2

- **Change the color of RGB LED using buttons**
  - Allocated the red, green and blue to each button
  - Change the color when the push buttons are pressed
- **Circuit diagram:**



Lab. 5 - Data Transmission

- **Blink The LED as many times as transmitted by serial monitor**
  - Transmit the numbers 0 to 9 to Arduino by a serial monitor