New Creation Circuit System Introduction Document

I Preface

The newly created circuit system consists of dozens of components and is a complex system of components with diverse functions and applications, and a high learning threshold. The preface of this document will introduce and explain the design concept and functions of the circuit system.

1.1 Mimetic and idealization of circuit systems

The newly created circuit system is based on realistic physics. For gameplay and complexity reasons, it is necessary to idealize the circuit system to a certain extent. The newly created circuit system may seem more realistic than the MC redstone circuit, while the system may seem very simple compared to reality.

In general, however, the threshold for learning the newly created circuit system is not high. The basic circuit components section requires only some knowledge of junior high school physics, while the remaining circuit components and the electromagnetic interaction section require some knowledge of high school physics.

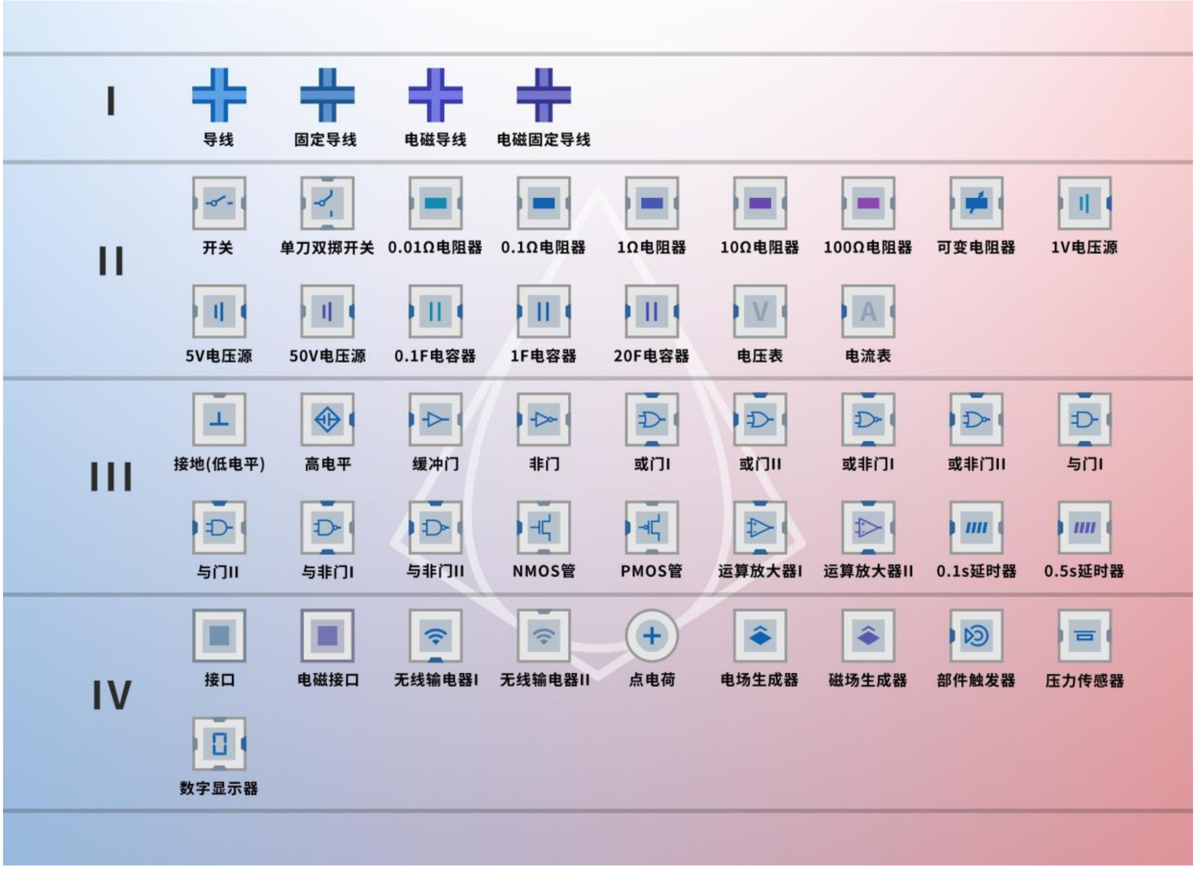
1.2 What does the circuit system consist of?

Currently, 48 circuit components have been added. They are classified by material and function as follows.

1. Wire category (no star material, 4 categories): wire, fixed wire, electromagnetic wire, electromagnetic fixed wire.
2. Basic circuit classes (one star material, 16 classes): switches, single-blade double-throw switches, resistors x 6, power supplies x 3, capacitors x 3, voltmeters, ammeters.
3. Integrated circuit class (two-star material, 18 categories): ground, high level, buffer gate, non-gate, or gate x 2, or non-gate x 2, with gate
× 2, with and without gates × 2, transistors × 2, operational amplifiers × 2, and time delayers × 2.
4. Electromagnetic and component control (Samsung material, 10 categories): interface,

electromagnetic interface, wireless transmitter x 2, point charge, electric field generator, magnetic field generator, component trigger, pressure sensor, digital display.

The functions of these components will be described in the subsequent content.



1.3 What can the circuit system do?

The circuit system functions in the following main categories.

1. Simulating realistic circuits and solving for data such as currents and voltages.
2. Construction of integrated circuits using components such as logic gates to create devices such as calculators and computers.
3. Automation of carriers using circuits for control of components.
4. Use the electromagnetic interaction mechanism to create electromagnetic cannons, particle gas pedals, and other machinery.

II Basic circuit introduction

2.1 Conductors

There are four classifications of conductor elements: wire, fixed wire, electromagnetic wire, and electromagnetic fixed wire.

The internal resistance of the wire is 0Ω, is the most basic component responsible for connecting the various parts of the circuit. Wires can withstand a maximum current of 50,000A, if the current flowing through the wire exceeds this value, the wire will be burned (the paste becomes gray).

Normal wires automatically connect adjacent circuit elements in all directions without the need to specify additional orientations. Fixed conductors can only connect adjacent circuit elements in a fixed direction, with a total of seven orientations (horizontal + vertical + four turn directions + vertical and horizontal cross) available.

Electromagnetic conductors can be subjected to amperage and are therefore used in electromagnetic drives (see the section on electromagnetic interaction for details). Ordinary conductors are not subject to amperage.

2.2 Switch

There are two classifications of switching elements: single-blade single-throw switches, and single-blade double-throw switches.

The single knife single throw switch is the most common type of switch. A single knife single throw switch has two ports and is used to control the opening and closing of a branch circuit. A single knife double-throw switch has three ports and is used to switch between two branches.

2.3 Resistance

Resistive components are a class of basic circuit components that have a certain resistance value.

There are six material categories of resistor elements. The first five resistors are fixed-value resistors with resistance values of 0.01Ω / 0.1Ω / 1Ω / 10Ω / 100Ω; the sixth resistor is a variable resistor that can be adjusted by a slider button with an adjustment range of 0.1Ω ~ 10Ω.

2.4 Power supply

Power supply components are a class of basic circuit components that can form a certain electric potential in a circuit to provide energy for other circuit components. Power supply elements have a certain internal resistance and are therefore not ideal power sources.

There are three material classifications of power supply components. The electric potential of the three power supply components are 1V / 5V / 50V, and the internal resistance is 0.05Ω.

2.5 Capacitance

Capacitive components are a class of basic circuit components that can store and release a certain amount of energy. When storing energy, a capacitor element can store charge by charging a power supply, and the voltage across it will gradually increase; when supplying energy, a capacitor element will have a similar effect as a power supply, but the voltage across it will gradually decrease, and the ability to supply energy will weaken over time.

The capacitance Q stored by a capacitive element and the voltage U across it satisfy the relationship $Q = CU$ where C represents the capacitance value of the capacitor in F (Farad). The value of C is generally fixed for the same type of capacitive element.

The capacitive element has a low internal resistance, so it can generate a very large current when supplying energy, and can be used in the manufacture of electromagnetic rail guns.

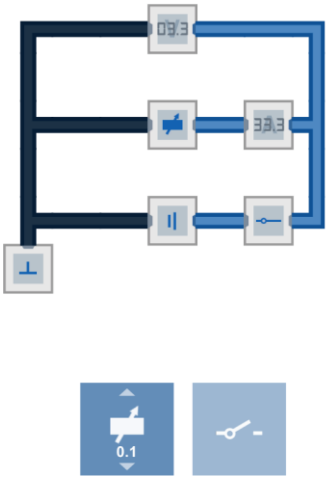
There are three material classifications of capacitive components. The capacitance values of the three capacitor elements are 0.1F / 1F / 20F, the maximum withstand voltage is 5V / 50V / 500V, and the internal resistance is 0.01Ω.

2.6 Voltmeter and ammeter

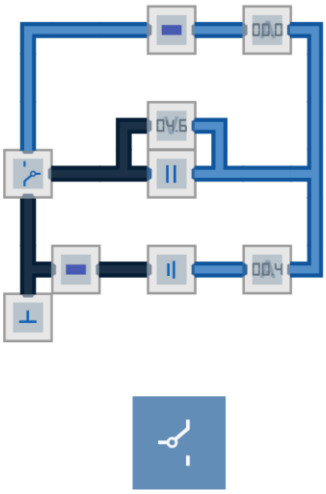
The voltmeter element and the ammeter element can be used to obtain the operation data of the circuit.

Generally, the voltmeter needs to be connected in parallel in the circuit, and the ammeter needs to be connected in series in the circuit. The internal resistance of the voltmeter element is 10000Ω, which is not an ideal voltmeter; the internal resistance of the ammeter element is 0Ω, which is an ideal ammeter.

2.7 Practical application: measuring the internal resistance of a power supply using a voltmeter and an ammeter



2.8 Practical application: observe the charging and discharging process of capacitors



III Introduction to Logic Circuits and Integrated Circuits

3.1 Electric potential and potential difference

Electric potential, also known as **potential, is** an important concept in electricity that describes the electric field in terms of energy.

Voltage, also known as **potential difference**, represents the difference in electrical potential between two points in a circuit. Both potential difference and electric potential are measured in V (volts).

In a normal circuit, only the voltage at two points can be measured, which means that only the relative difference between the potentials can be determined, but not the absolute value of each potential. Therefore, it is necessary to set a potential reference point in the circuit, which is defined as a certain value (e.g., 0), to determine the potential value at each of the remaining points.

The ground (low level) element and the high level element serve precisely this purpose, as they set the potential reference point in the circuit.

3.2 Low and high levels

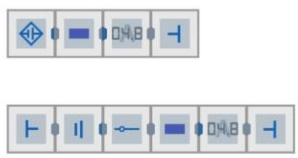
A grounded (low level) element can determine a low level reference point in the circuit at a 0V level, and a high level element can determine a high level reference point in the circuit at a 5V level (in effect, the high level is a series connection between the grounded element and the 5V supply). With the addition of a reference point, the wires in the circuit also change brightness depending on the potential level.

For all logic circuit components, a potential signal between -10V and 2.5V will be considered a low signal, a potential signal between 2.5V and 10V will be considered a high signal, and a potential signal that is out of range or whose absolute potential value cannot be determined (i.e., dangling) will be considered invalid. If a logic circuit element contains an invalid input signal, it will generally become disabled (grayed out mapping). Therefore, from the logic circuit point of view, the ground element can input a low level signal (i.e., logic 0) and the high level element can input a high level signal (i.e., logic 1).

Generally speaking, a circuit needs to form a loop in order to generate current. However, by adding grounding elements at each end of a circuit path, the potential at both ends can be determined and no longer suspended, and the conditions for current generation can be met. Therefore, grounded and high-level components can be used in the manufacture of loopless circuits. Most logic circuits are loopless (of course, they can be converted into loops, but this makes the circuit more complex).

I.无接地的回路式电路

II.接地的回路式电路



III.两端接地的无回路式电路

3.3 Logic Gates

Logic gate circuits are used in the operation of logical relations and are one of the important components of logical digital circuits. The most basic logical relations are logical with, logical or, and logical not. Generally, in a logical state, **0 represents a** low level and **1** represents a high level.

The newly created circuit system will provide the following logic gate elements: buffer gate, non-gate, or gate, or non-gate, with gate, and without gate. The delay of a single logic gate is 1tick (1tick = 0.02s, i.e. 50tick = 1s in the new creation).

Buffer Gate / Non-gate

The buffer gate and the non-gate both have one input and one output. Their truth tables are as follows.

Inp ut	Output (buffer gate)	Output (non-gate)
0	0	1
1	1	0

It can be seen that the output of the buffer gate is aligned with the input, while the output of the non-gate is opposite to the input. Therefore, the buffer gate can be used as a 1-tick delay.

Or gate / or not gate

Both or and non-gates have two inputs and one output. Their truth tables are as follows.

Input A	Input B	Output (or gate)	Output (or non-gate)
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

As you can see, as long as one of input A and input B is 1, then the or gate will output 1 and vice versa, and the output of the non-gate is the opposite of the or gate.

Both or-gate and non-gate have two materials respectively, which differ in the orientation distribution of the inputs.

With gate / With non-gate

Both with and without gates have two inputs and one output. Their truth tables are as follows.

Input A	Input B	Output (with gate)	Output (with and without gate)
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

It can be seen that as long as one of input A and input B is 0, then the with gate will output 0, and vice versa the with gate will output 1. The output of the with and without gate is opposite to the output of the with gate.

Both with and without gates have two materials respectively, which differ in the orientation distribution of the inputs.

3.4 Transistors (NMOS tubes / PMOS tubes)

In reality, two types of field effect transistors (FETs), NMOS and PMOS, together form CMOS circuits and are widely used in the manufacture of integrated circuits.

In the new creation, the transistor does not have the complex characteristics of the real one, but has been somewhat simplified and idealized. The transistor has three ports, one of which is the control terminal. In the case of NMOS tubes, when the control is 0, the other two ports are open, and when the control is 1, the other two ports are closed. For PMOS tubes, the other two ports are closed when the console is 0 and closed when the console is 1.

Therefore, the transistor in the new creation does not have amplification characteristics and is more similar to a relay, which can control the opening and closing of the line by the potential level of the control terminal.

3.5 Operational Amplifiers

Operational amplifiers, or op amps for short, are commonly used in analog circuits.

The operational amplifier in the Suntron circuit system is simplified to have only two inputs and one output. The op-amp will make a difference between the potentials of the two inputs and multiply them by a certain factor to end up with the output voltage, which is $V_{out} = A \cdot (V_+ - V_-)$. Where A is the coefficient multiplied by the difference and is called the open-loop differential gain. The open-loop differential gain of the op-amp in the Suntron circuit system is 1000, and the output voltage is limited to between -10V and 10V.

Operational amplifiers have a variety of uses, either as comparators or in analog arithmetic circuits. Unlike reality, the output voltage of a high-gain op-amp will often fail to converge to a fixed value because the newly created circuit system performs discrete frame-by-frame operations. Therefore, the op-amp will have two materials, the first with an unbuffered output voltage, which allows for abrupt changes, and the second with a buffered output voltage, which does not allow for abrupt changes (i.e., the output voltage will be limited in the amount of change per frame).

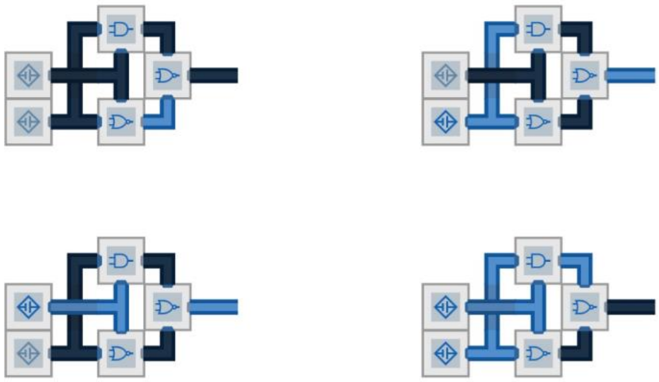
3.6 Delay timer

The delay timer has one input and one output, which can delay the input

signal for a certain time and then output it. The delayers are available in two

materials, 0.1s (i.e. 5tick) and 0.5s (i.e. 25tick) respectively.

3.7 Practical application: building heterogeneous gate logic circuits



IV Introduction to electromagnetic interaction and component control circuits

4.1 Interface

The interface is similar to a wire in that it serves to connect all parts of the circuit and has an internal resistance of 0 Ω. The difference is that the wire can only form an intrinsic circuit connection based on the connection between the parts; the interface can form both an intrinsic circuit connection and a dynamic circuit connection through spatial contact between the interface and the interface.

The interface has a total of two classifications: interface and electromagnetic interface. Similar to the wire, the electromagnetic interface can be subjected to amperometric forces, while the normal interface cannot.

4.2 Wireless transmitter

A wireless transmitter is capable of transmitting circuit signals over long distances and can be considered as a wire with internal resistance that can be connected wirelessly. A wireless transmitter has a port.

There are two classifications of wireless transmitters: transmitters and receivers. Each transmitter can be connected to multiple receivers, and each receiver will only be connected to the transmitter that is closest to it. Wireless transmitters have a transmission distance limit (16m) and the longer the distance, the higher the resistance.

4.3 point charge

Point charges are classified as positive or negative, with a charge of 20C or -20C. Point charges have no ports and are not connected in conventional circuits.

The electrostatic force (i.e., Coulomb force) will be generated between point charges. The electrostatic force equation is $F = \frac{kq_1q_2}{r^2}$, where k is the electrostatic force constant, q1 and q2 are the charges of the two point charges, and r is the distance between the two point charges. Unlike reality, the value of k in the newly created circuit system is only taken as 1.5 to avoid the electrostatic force between the point charges to be too large.

4.4 Electric field generator

The electric field generator can generate a circular electric field with a radius of 8m. Within a radius of 4m, the electric field is a uniform electric field; within a radius of
The electric field strength of this electric field will decay with distance in the range of 4m~8m. The electric field generator has no port and is not connected in the conventional circuit.

A point charge in an electric field is subject to the electric field force, which is given by the formula $F = Eq$, where E is the electric field strength at the corresponding location and q is the charge of the point charge.

4.5 Magnetic Field Generator

The magnetic field generator can generate a circular magnetic field with a radius of 8m. Within a radius of 4m, the electric field is a uniform magnetic field; within a radius of
The magnetic induction strength of this field will decay with distance in the range of 4m~8m. The electric field generator has no port and is not connected in the conventional circuit.

A point charge in a magnetic field is subject to the Lorentz force, which is given by the formula $F = Bvq$, where B is the magnetic induction intensity at the corresponding position, v is the relative velocity between the point charge and the magnetic field, and q is the charge of the point charge. The direction of the Lorentz force can be determined by the left-hand rule, the details of which can be found in the related materials.

$F = BIL$charged wire in a magnetic field is subjected to the amperometric force, which is given by the formula, whereB is the magnetic induction at the corresponding location, I is the current strength of the wire, and L is the projected distance of the wire in a direction perpendicular to the magnetic field. The direction of the amperometric force can be determined by the left-hand rule, the details of which can be found in the relevant materials.

4.6 Part Triggers

The part trigger can control the opening and closing of the part by means of an electrical signal input. The part trigger has an input with a valid potential value.

4.7 Pressure sensors

Pressure sensors, or varistors, are a special class of resistors whose resistance varies with pressure. Pressure sensors have two ports.

The resistance R of a pressure sensor is related to the pressure F applied to it by $R = \min(\frac{500}{F}, 10000)$. That is, its resistance is inversely proportional to the pressure within a certain range and has a maximum resistance of 10000Ω.

4.8 Digital Display

The digital display is capable of displaying a hexadecimal character. The digital display has four inputs, each of which must have a valid potential value.

The four inputs of the digital display together form a four-digit binary number, which is equivalent to a one-digit hexadecimal number, located between 0 and 15.

4.9 Practical application: using high frequency pulses with component triggers to drive nuclear TNT engines