SGD

Gravimetric Doser

Date: Aug. 2023

Version: Ver. E (English)

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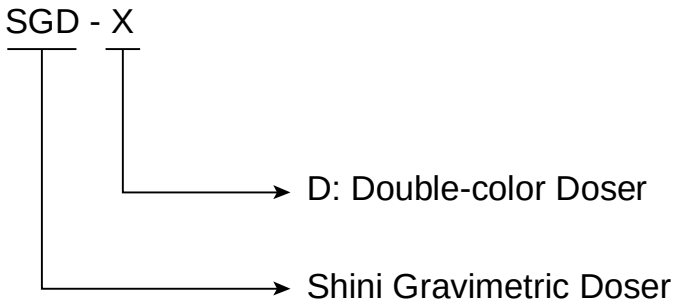
1. General Description

Please read this manual carefully before installation and using of the machine to avoid damage or personal injuries.

SGD series masterbatch doser utilizes a precision servo system and PLC control. The unit is suitable for the accurate dosing proportion of masterbatch, virgin material, regrind material, or additives receipts in the injection and extrusion process. The output range from 0.04~32kg/hr. Otherwise, a dual-color doser can be available according to the customer's requirements.

Picture 1-1：Single Color Doser

1.1 Coding Principle



1.2 Features

- Dosing screws are chrome plate for durability.
- SGD adopts a precision servo system and PLC control for accurate and stable feeding, quick response.
- Unit is comprised of standard modules for ease of cleaning, disassembly and interchangeability.
- Compulsory material cleaning makes it easier to replace masterbatch.
- The current operation mode can be recorded, unaffected by power failure so operation would be returned to normal when power is on.
- Ethernet communication is available to transmit data
- Support USB data update
- Manipulate dosing process via loss-in-weight technology, satisfying the high requirement of production precision.
- Support auto compensation of recycled materials in double color mode.

All service work should be carried out by a person with technical training or corresponding professional experience. The manual contains instructions for both handling and servicing. Chapter 6 contains service instructions intended for service engineers. Other chapters contain instructions for the daily operator.

Any modifications of the machine must be approved by SHINI in order to avoid personal injury and damage to machine. We shall not be liable for any damage caused by unauthorized change of the machine.

Our company provides excellent after-sales service. Should you have any problem during using the machine, please contact the company or the local vendor.

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1.3 Safety Regulations

Strictly abide by the following safety guide to prevent damage of the machine or personal injuries.

Safety regulations should be abided by while operating the machine.

1.3.1 Safety Signs and Labels

All the electrical components should be installed by qualified electricians. Turn off the main switch and control switch during maintenance or repair.

Warning!

High voltage!

This sign is attached on the cover of control cabinet!

Warning! Be careful!

Be more careful at the place where this sign appears!

Attention!

No need for regular inspection because all the electrical parts in the control unit are fixed tightly.

1.3.2 Service Environment

Don’t use this equipment in the room with corrosive gas and direct sunlight.

In the dry environment indoor, the maximum temp. shall not exceed +45℃, and the humidity shall not exceed 80%..

1.4 Exemption Clause

The following statements clarify the responsibilities and regulations born by any buyer or user who purchases products and accessories from Shini (including employees and agents).

Shini is exempted from liability for any costs, fees, claims and losses caused by reasons below:

1) Any careless or man-made installations, operation and maintenances upon machines without referring to the Manual prior to machine using.
2) Any incidents beyond human reasonable controls, which include man-made vicious or deliberate damages or abnormal power, and

machine faults caused by irresistible natural disasters including fire, flood, storm and earthquake.

3) Any operational actions that are not authorized by Shini upon machine, including adding or replacing accessories, dismantling, delivering or repairing.
4) Employing consumables or oil media that are not appointed by Shini.

2. Structure Characteristics and Working Principle

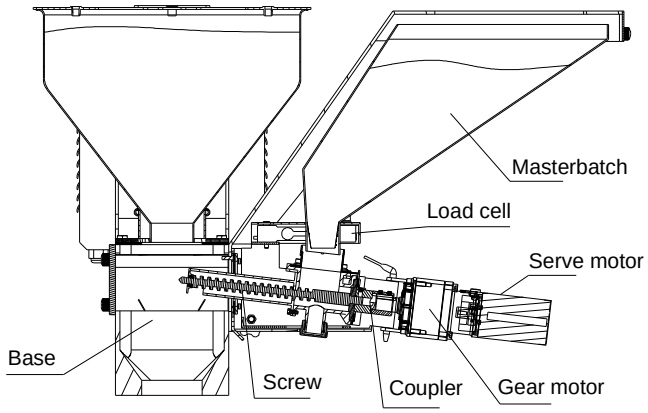
2.1 Function Description

SGD series of dosers are suitable for auto-proportional mixing of virgin material, regrinds, masterbatch or additives. Double color doser can be assembled from two single-color dosers according to customers' requirements.

Note:

When the master batch hopper is mounted with the auto conveying device, the total weight of the hopper shall not exceed 25KG (including the master batch).

2.2 Working Principle



Picture 2-1：Gravimetric Doser Working Principle

Servo motor is controlled via industrial PLC from the control box. The servo motor begins to work and the rotary force is transferred to dosing screw through shaft connector. Master batch in hopper falls into the groove of conveying screw, and then be taken to hopper base by rotating action of the screw. Load cell is adopted to precisely control master batch output to fulfill proportional dosing.

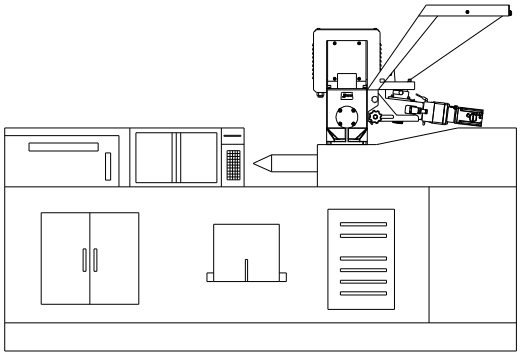
3. Installation and Debugging

Read this chapter carefully before installation. Install the machine by following steps.

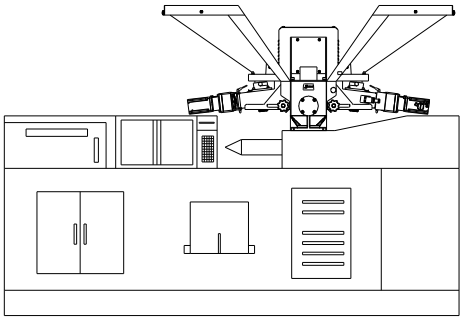
This series of models can only be used in well-ventilated working environment.

Power supply of Doser should be done by qualified electricians!

3.1 Mounted on the Injection Moulding Machine / Extruder



Picture 3-1：Single-color Doser Installation Diagram



Picture 3-2：Double-color Doser Installation Diagram

According to the installation hole size of the IMM or extruder, install the doser on the IMM or extruder (as shown above), and lock the four fixing holes on the mounting base.

3.2 Power Connection

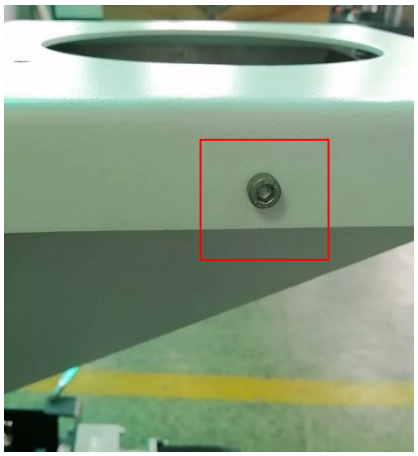
1) Make sure the voltage and frequency of the power source comply with those indicated on the manufacturer nameplate that attached to the machine.
2) Power cable and earth connection should conform to your local regulations.
3) Use independent electrical wires and power switch. Diameter of electrical wire should not be less than those used in the control box.
4) The power cable connection terminals should be tightened securely.
5) The machine requires 3-phase 4-wire power source, connect the power lead (L1, L2, L3) to the live wires, and the earth (PE) to the ground.
6) Power supply requirements:
   Main power voltage: +/- 5%

   Main power frequency: +/- 2%

7) Please refer to electrical drawing of each model to get the detailed power supply specifications.

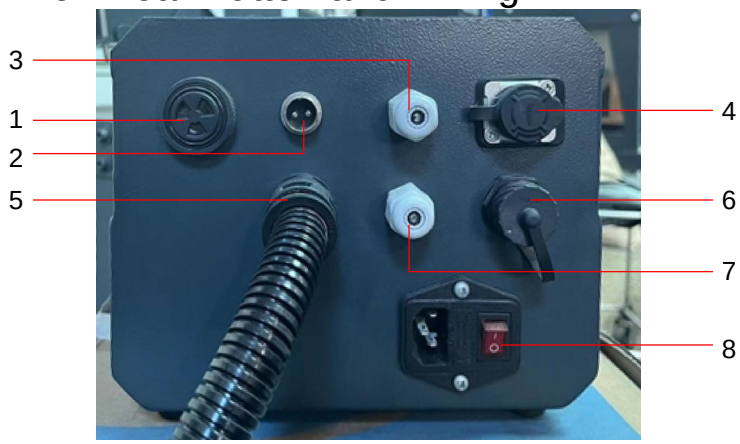
3.3 Load cellProtective Screw

Remove the load cell protective screw before machine operation.



Picture 3-3：Load Cell Protective Screw

3.4 Control Box Rear Button and Wiring



Picture 3-4：Rear Control Box Panel

Table 3-1: Function Description of Rear Control Box Panel

No.	Name	Function	Description
1	Buzzer	buzzer warning	
2	Signal wire interface	External connection signal during machine running	1) In injector mode, the signal it received is the melt adhesive signal of passive switching value. 2) It is the extruder running signal 0~10V, refer to the circuit diagram.
3	Suction signal interface 1	Loader 1 running enable signal	
4	Ethernet interface	Communicate with external signal	
5	Drive cable + power cable + load cellwire	Connection between servo drive control box and host control box	
6	USB interface	USB disk socket	Support screen U disk update and alarm record reading
7	Suction signal interface 2	Loader 2 running enable signal	
8	Power outlet wire	Power supply of machine	Power Spe.: single-phase three wire, power firing wire (L), zero wire (N) and grounding wire

4. Application and Operation

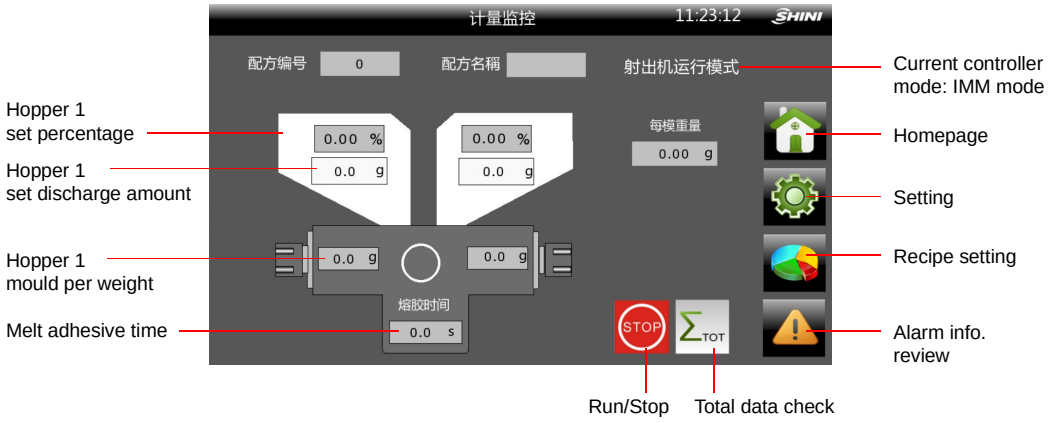
4.1 Operation Guide

4.1.1 Boot Screen

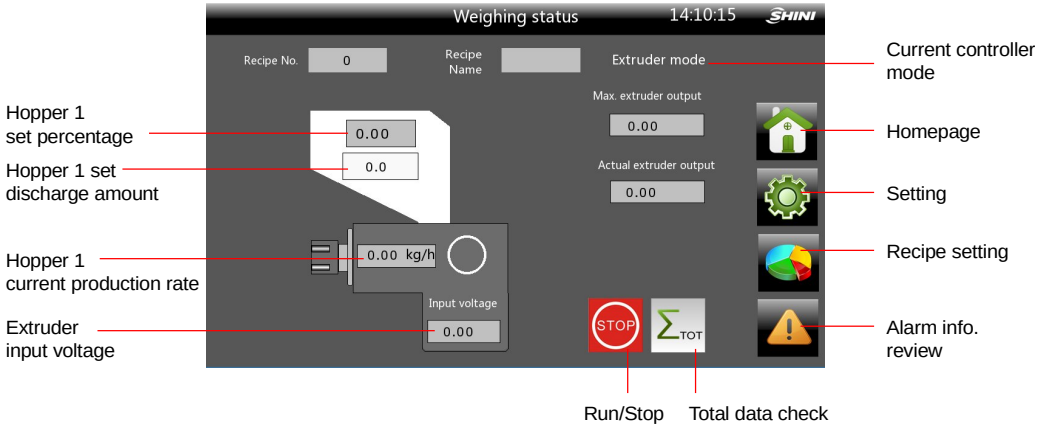
Picture 4-1：Boot Screen

4.1.2 Monitoring Screen

Click the <Enter> button in the boot screen to enter the monitoring screen.



Picture 4-2：IMM Metering Monitoring Screen

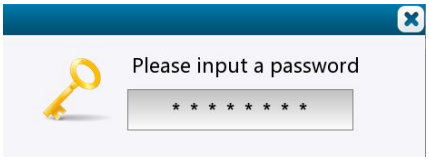


Picture 4-3：Extruder Metering Monitoring Screen

Table 4-1: Function Description of Metering Monitoring Screen

No.	Name	Function Type	Function Description
1	Hopper 1(2) Doser set proportion	Only display	Display the proportion of current recipe hopper 1 (2)
2	Hopper 1(2) total weight	Only display	Display the total weight of current hopper 1(2)
3	Hopper 1(2) current production rate	Only display	Display the current production rate of hopper 1(2)
4	Extruder input voltage	Only display	Display current voltage value of the extrusion voltage it received.
5	Current running mode	Only display	Display current operation mode
6	Run Switch	Button	 standby status,  running state
7	Total data check	Button	When clicking, switch the total data and check the screen.
8	Homepage	Button	When clicking, switch the boot screen.
9	Setting	Button	Switch parameter set screen when clicking.
10	Recipe setting	Button	Switch the recipe setting screen when clicking.
11	Alarm prompt	Button	Switch the alarm and check the screen when clicking.

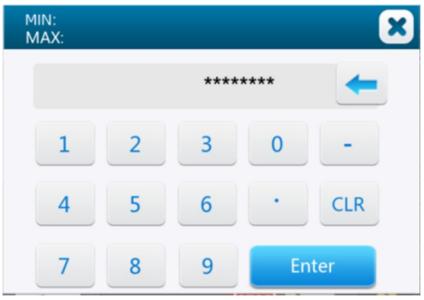
4.1.3 User Name and Password Screen



Picture 4-4：Password Screen

Password：3588

4.1.3.1 Operation Keyboard



Picture 4-5：Numeric Keypad

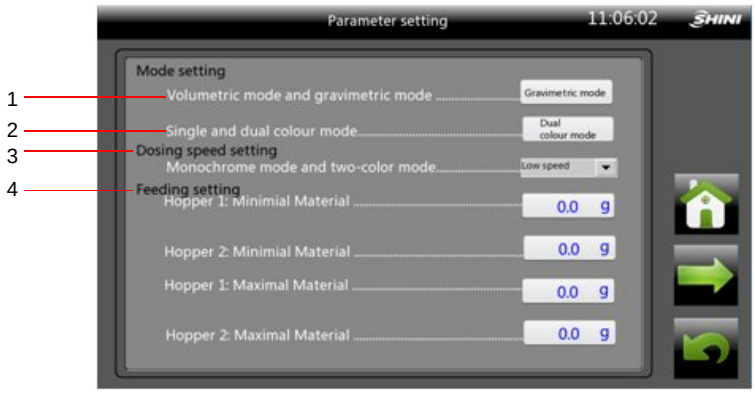
4.2 Machine Setting Screen

Click the <Setting> button on the metering monitoring screen to enter the machine setting screen:

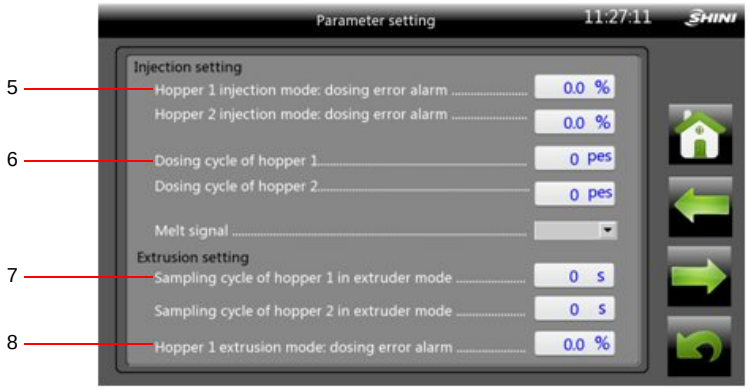
Picture 4-6：Machine Setting Screen

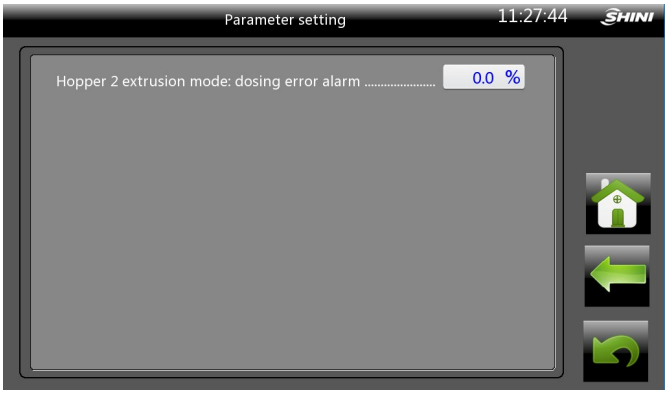
4.2.1 Parameter Setting

Click the < Parameter Setting > button on the machine setting screen to enter the parameter setting screen.



Picture 4-7：Parameter Setting Screen 1





Picture 4-8：Parameter Setting Screen 2

1) Volumetric mode and gravimetric mode

   Click the <weighing mode> button to switch between the volumetric mode and weighing mode; The gravimetric mode has loss-in-weight adjustment function, while the volumetric mode without adjustment function, and the discharging speed is constant.

2) Single color mode and double-color mode

Click <double color mode> button to switch between the single color and double color mode.

3) Rotating speed setting

Three speeds can be customized according to the demand output

Note: Select corresponding rotating speed mode based on reference output range to ensure more accurate feeding.

Table 4-2: Rotating Speed Setting

No.	Rot. Speed Mode	Speed Value rpm	Reference Output Range Kg/hr	Description
1	Low speed mode	75	0.1~8kg/h	
2	Middle speed mode	150	8~16kg/h	
3	High speed mode	300	16~32kg/h	Factory default high-speed mode

4) Feeding Setting

The min. feeding amount and max. feeding amount. When the weight of materials in the hopper is less than the min. feeding amount, it will activate the suction enabling. After three times of suction enabling, when the hopper material weight is less than min. feeding g amount, it will give shortage alarm;

When the material weight in the hopper is greater than the max. feeding amount, the suction will stop.

5) Metering Out-of-tolerance Alarm in IMM mode

In the IMM mode, when each batch feeding amount exceeds the set value allowable error, it will give alarm and the set default is 2%.

For example, set the weight per mould to 100g, the masterbatch ratio to 10%, and the out-of-tolerance alarm to 2%. That means the actual value within 8%~12% is normal. Otherwise, it will give alarm.

6) Discharging Cycle

When the discharging cycle is set to 1, according to the set recipe, once there is the Melt signal at this time, the masterbatch will be discharged one time based on the recipe. When the recipe calculated that the dosage of masterbatch per mould is very small, for example, the dosage of masterbatch per mould it calculated is 0.2g. At this time, for precise measurement, the discharge cycle can be set to 2, if there are twice Melt

signals during machine running, the total weight of once masterbatch output is 0.4g.

7) Melt Signal Control Type
   a. External signal & Melt time
   b. External signal: When the Doser is working, the signal is determined by the external signal.
   c. Melt time: When the Doser is working, the signal is determined by the set melt time signal.
   d. Upper mould time: When the Doser is working, the signal is determined by the melt time signal received by the upper mould.

   When it is set to a, the Doser screw feeding time is determined by the shorter one of external signal or set melt time.

   When setting to selection a, the dosing screw working time is determined by the shortest timing of the two modes, external signal or injection melt time. For example, after the IMM working signal is over, but the Doser set melt time still lasts, the Doser screw will stop feeding; When the IMM working signal still lasts, but the Doser set melt time is over, the Doser screw will stop feeding at the same time.

   When setting to selection b, the Doser screw will stop feeding only when the external signal is disconnected.

   When setting to selection c, the Doser screw will stop feeding only when the melt time is over.

   When setting to selection d, it will drive the screw based on the melt time read by the upper mould.

8) Extruder Mode Sampling Cycle

   Sampling Cycle: In the extruder mode, the machine will collect the hopper weight at set intervals, and the PLC will adjust the output speed according to the weight collected to increase or decrease the feeding output.

   Notes: The shorter the sampling cycle, the faster the adjustment speed, with unstable discharge speed; The longer the sampling cycle, the slower the adjustment speed, with stable discharge speed but long adjustment time; The factory preset is 8S.

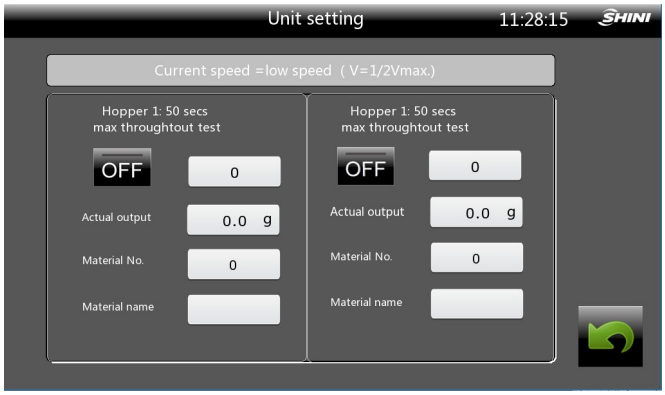
9) Metering Out-of-tolerance Alarm in extruder mode

In the extruder mode, when the feeding amount of each sampling cycle exceeds the set value allowable error, it will give alarm, and the set default is 2%.

For example: set the extruding output to 36kg/h, the masterbatch ratio to 10%, and the out-of-tolerance alarm to 2%. That means the actual value within 10%±2% is normal. Otherwise, it will send an alarm.

4.2.2 Unit Setting

Click<Unit Set.>in the parameter setting screen to enter the unit setting screen.



Picture 4-9：Unit Setting Screen

4.2.2.1 50s maximum output test method

1) Use a container to catch the materials dropped along with the screw at the outlet.
2) Press the "lower hopper (1) 50S maximum output test" <OFF>switch, and the system will finish 50S output automatically.
3) Take the masterbatch in the container onto the scale and weigh out it, and input the value into the column of "Actual output of hopper (1)".
4) Complete the 50s maximum output test.

4.2.2.2 Material Number

Number the current materials, and it can switch between different material numbers to fill in actual output and material name. Fill in the name of material, and the number can be called in the recipe setting.

Important:

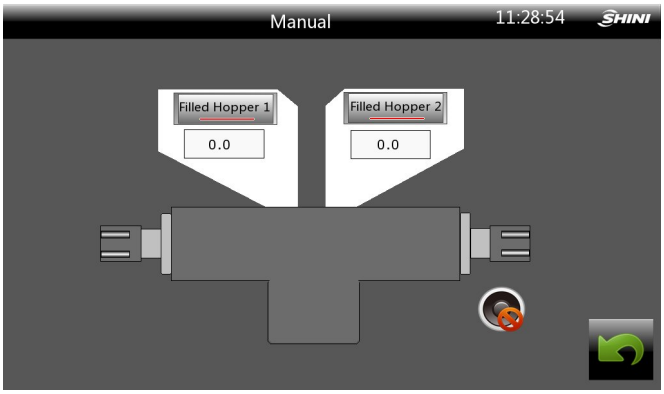
Each kind of material only has one number, which is unique.

4.2.2.3 Material Name

Give the name of current material.

4.2.3 Manual Filling

Click the<Manual Fill>button in the parameter setting screen to enter the manual fill screen.



Picture 4-10：Manual Fill Screen

Click the <Hopper 1 Fill> button to fill the materials into the screw. When the materials flow out evenly, it means material filling is completed.

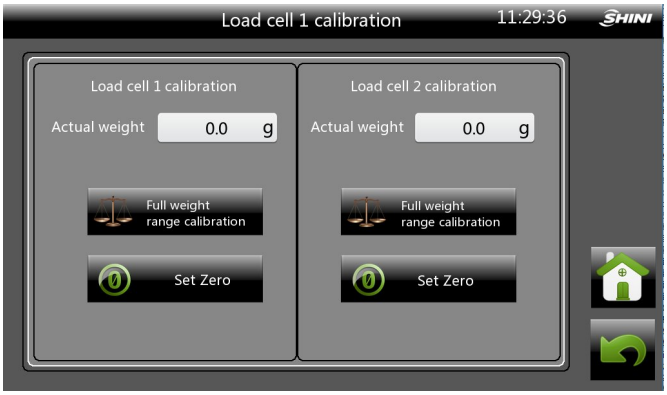
Important:

In the unit setting, start manual filling before 50S maximum output test or material replacement.

4.2.4 Weight Calibration

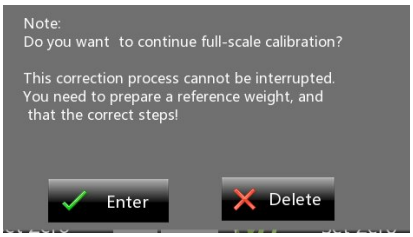
Perform weight calibration after replacing the load cell or when the scale has no weight display, and the steps are as follows:

1) Click the<Weight Calibration> button in the parameter setting screen to enter the metering scale calibration screen.



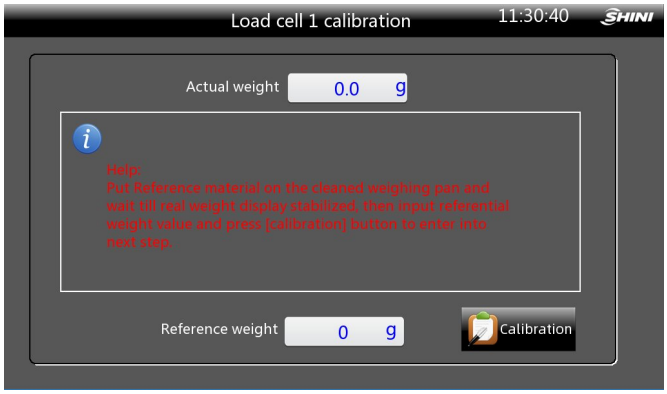
Picture 4-11：Weighing Calibration Screen

2) Click the<Full Scale Calibration> button to enter the calibration prompt screen, and calibrate the weight of hopper 1 and hopper 2 respectively.



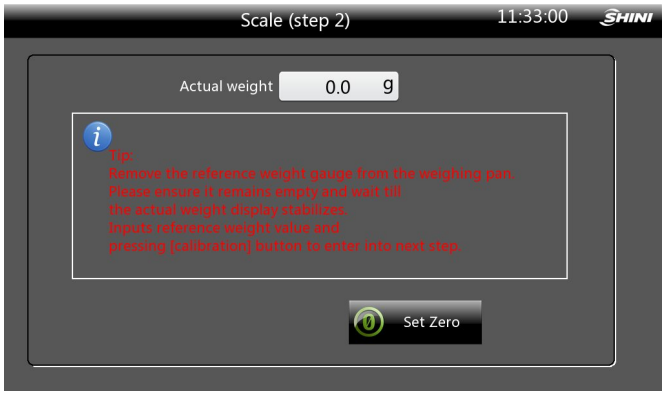
Picture 4-12：Weighing Prompt Screen

3) Click the<OK>button to enter the calibration step 1 screen.



Picture 4-13：Calibration Step 1 Screen

4) Put the standard weight into hopper 1 or hopper 2, enter the standard weight in the reference weight in the calibration step 1 screen, and click the <Calibration> button to enter the calibration step 2 screen.



Picture 4-14：Calibration Step 2 Screen

5) Enter the calibration step 2 screen, wait for the hopper 1 or hopper 2 to read the weight, and take out the weight from hopper 1 or hopper 2 after about 5 secs. Wait for about 5 secs. and click the <Weight Reset> button to return to the weighing calibration screen to complete the calibration process.

4.2.5 Language Selection

Click<Lang. Selection>in the parameter setting screen to enter the language selection screen, where the user can select the language as required

Picture 4-15：Language Selection Screen

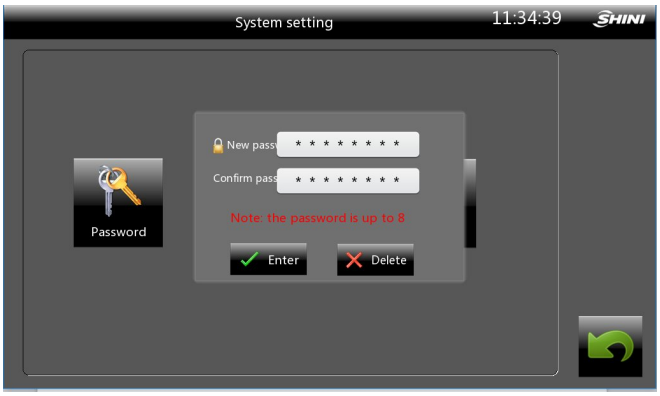
4.2.6 System Setting

Click<System Set>in the parameter setting screen to enter the system setting screen.

Picture 4-16：System Setting Screen

4.2.6.1 Password Management

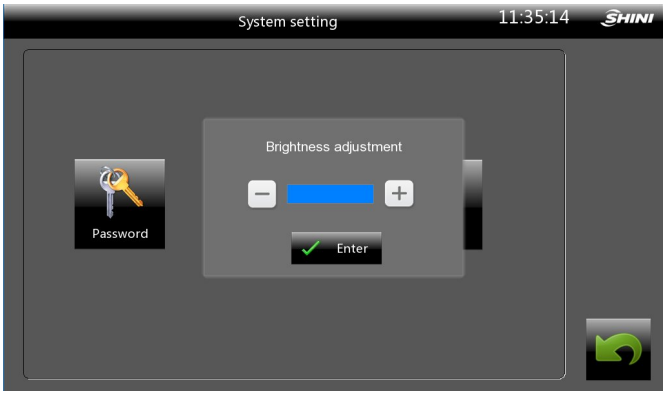
Click<Password Mgt.> and it pops up the password modification screen, where the password can be changed as demand.



Picture 4-17：Password Management Screen

4.2.6.2 Display Settings

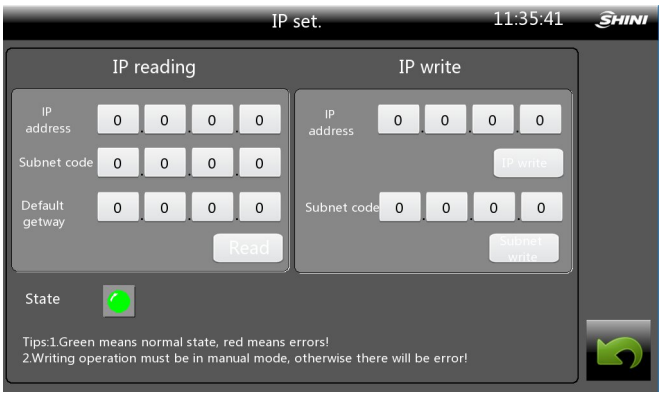
Click<Display Settings>, it pops up the brightness adjustment screen, where the screen brightness can be changed as demand.



Picture 4-18：Brightness Adjustment Screen

4.2.6.3 IP Setting

Click<IP Setting>to switch to the IP setting page, where it can read the IP address of the PLC or write a new IP address to the PLC.

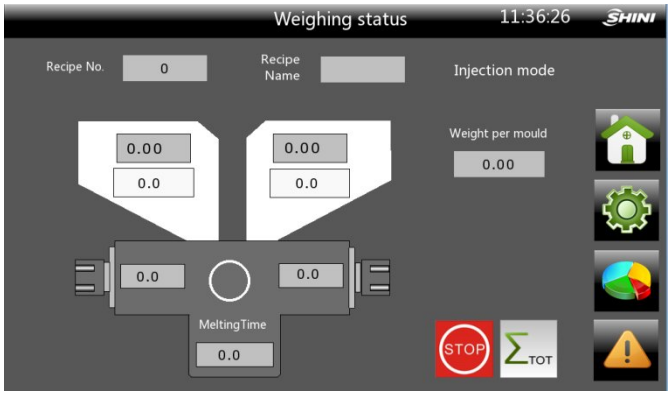


Picture 4-19：IP Setting Screen

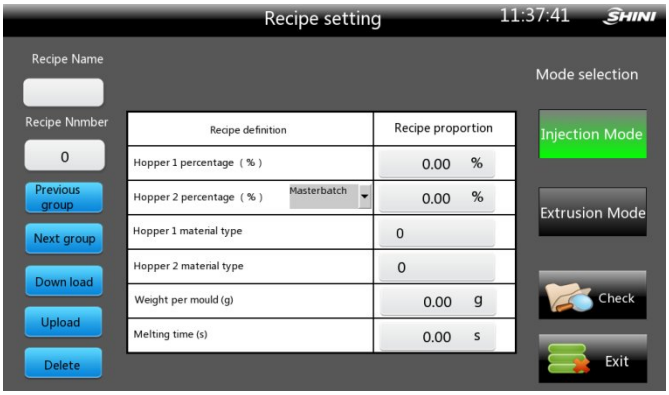
4.3 IMM Operation Process

4.3.1 Recipe Setting

Click the<Recipe Setting> button in the metering monitoring screen to enter the recipe setting screen.



Picture 4-20：Metering Monitoring Screen



Picture 4-21：Recipe Setting Screen

In the recipe setting screen, click the <Injection Mode>.

1) Recipe Name

   Give the name of current recipe

2) Number the recipe

   Number the current recipe, and bind the recipe number and name, and it can click the <Previous Group>or<Next Group>to switch different recipes.

3) Complete the setting of hopper 1 percentage, hopper 2 percentage, weight per mould, melt time, hopper 1 material type, hopper 2 material type.

   Note 1:

   Hopper 2 can select the masterbatch or recycled materials. Selecting the recycled material means enabling the auto compensation function of recycled material; Selecting the masterbatch means using the normal metering mode.

Note 2:

Auto compensation function of recycled materials: Once the hopper 2 selects to use the recycled materials, when the hopper 2 level is lower than the set low level, it will stop the feeding motor of hopper 2 automatically. The system will convert the unfinished recycled material into the masterbatch, and increase the masterbatch feeding output of masterbatch in hopper 1 to correct the color difference;

After the feeding of hopper 2 is completed, when the material level is higher than the set low level again, it will close the auto compensation function, and the feeding mode will return to previous feeding mode.

4) Click the<Download>button to download the recipe, and the corresponding parameters of the recipe will be transferred to the monitoring metering screen.
5) Click the<Upload>button to upload current recipe in the PLC to HMI.

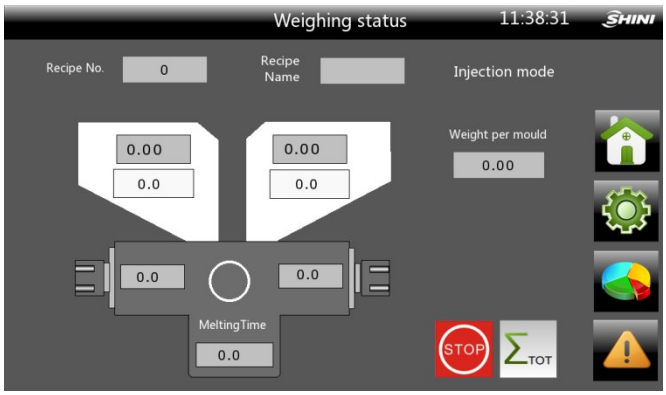
Important:

The uploaded recipe will cover current recipe. Please operate carefully!

6) Click the<Delete>button to cancel the current recipe.

Important:

The recipe can't be restored after cancelation. Please operate carefully!



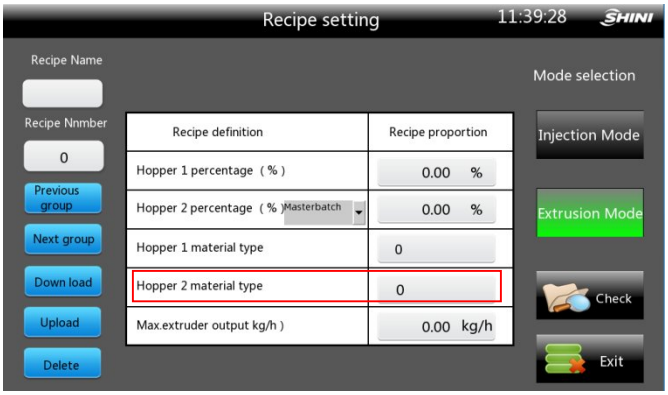
Picture 4-22：Metering Monitoring Screen

7) Click the<Run Switch>button to display the ON status.

8) After it is set to IMM mode, the system will work according to IMM program.

4.4 Operation under Extruder Working Mode

Extruder working mode: When adding virgin materials or replacing masterbatch, fill up the screw, take 50 secs. test and perform other operation steps and the processes are the same as the IMM working mode. However, the recipe setting is different from the IMM mode.

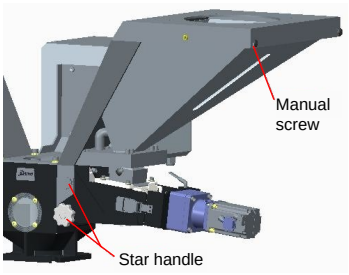


Picture 4-23：Recipe Setting Screen

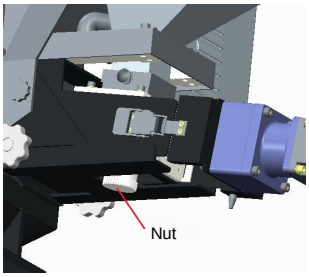
Click the<Extrusion Mode> button to switch the extruder recipe. The recipe saving and recipe downloading are the same as the extruder mode. In recipe setting, the maximum output (kg/h) set value of the extruder should be changed with the actual output of the extruder.

4.5 Material Replacement

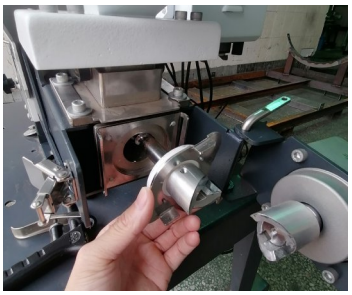
1) Loosen the star handle and manual screw, and take the hopper out.
2) Unscrew the nut at the hopper discharge port, rotate the screw fixing plate, remove the screw, and blow off the residual master batch with the compressed air.
3) Open the snap hook, pull out the screw, and use the air gun to blow inside the conveying pipe.
4) After cleaning, assemble them in reverse order, add feed the new master batch to replace the materials.
5) After replacing the new master batch, it has to take the 50S test again.



1)



2)



3)

4)

Picture 4-24：Material Replacement

5. Trouble Shooting

Table 5-1: Controller Failures and Solutions

Failures（Alarm text）		Possible Reasons	Solutions
Touch panel no display		1. Power disconnected.	1. Connect to the power.
		2. Fuse broken or control cable damaged.	2. Replace the fuse or check the control circuit.
Fault Text	Recipe setting error	1. Exceed max. output range of machine	1. Reset the recipe.
	Servo driver alarm	1. Motor overload	1. Disconnect the power and reconnect it after troubleshooting.
		2. Motor damage	2. Replace motor.
		3. Servo driver fault	1. Click the reset button to reset. 2. Power off and restart 3. Check whether the power line and coding line are connected properly. 4. Replace the servo driver.
	Material shortage alarm	The material level in the hopper is lower than the min. set value	Check the stock status of materials.
	High input voltage alarm	High voltage input	Check the voltage of signal supply.
	Load cell broken	Load cellpoor connected or sensor fault	1. Fasten the wire or replace the sensor.
	Metering out-of-tolerance alarm	The difference between the actual feeding amount and set feeding amount exceeds the alarm set value	1. Check the cause of large fluctuation of actual feeding amount. 2.Increase the metering out-of-tolerance alarm value in the injection mode/ metering out-of-tolerance alarm value in the extrusion mode 3. Check whether the screw is blocked.

Table 5-2: Common Fault Codes and Solutions of Driver

Fault Code	Code Meanings	Reasons/Solutions
Er.136	Data verification error or parameter not recorded in motor encoder ROM	1. Press reset 2. Restart 3. Replace the driver
Er.610	Driver overload	1. Check whether the circuit has poor contact. 2. Motor overloaded, and
Er.620	Motor overload	

		reduce the load.
Er.630	Blocked motor overheat protection	1. Check whether the motor is phase shortage. 2. For motor blocked due to mechanical factors, remove the mechanical factors.
Er.640	Junction temperature too high	1. Too high ambient temp. 2. Driver fan damaged.
Er.650	Cooler overheat	
Er.B03	Elec. gearing setting over limit	1. Press reset. 2. Power on again.
Er.D03	CAN comm. disconnected	1. Check the wire connection.
Er.909	Motor overload warning	1. Check whether the circuit has poor contact. 2. Motor overloaded, and reduce the load.
Er.941	Power on again when changing parameters	1. Power on again.

6. Maintenance and Repair

6.1 Repair

All the repair work should be done by qualified technicians to prevent personal injuries and damage of the machine.

6.2 Maintenance

Keep the surface of machine clean.

Please don't clean with petroleum solvent to avoid damaging on the surface.

6.3 Maintenance Schedule

6.3.1 About the Machine

Model：_____ No.：_____ Manufacturing date : _____

Voltage ____ Φ_____V Frequency：____Hz Total power: _____ kW

6.3.2 Check after Installation

☐Check that dosing screws are fitted correctly.

☐Check the motor is tightly locked.

☐Check if the mounting base is firmly locked.

☐Check whether the load cellscrews are removed.

Electrical Installation

☐Voltage: _____ V _____ Hz

☐Fuse melt current:1Phase _____A 3 Phase_____ A

☐Power supply and signal wires of control cabinet are correctly connected.

6.3.3 Daily Checking

☐Check the main switch.

☐Check fastening screws of mounting base.

6.3.4 Weekly Checking

☐Check if there damaged electrical wires.

☐Check snap hooks are loose or not.

☐Check if the side holding plate is loose or not.