USER MANUAL

MOR200_BRA

Pulp Consistency Controller

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MOR200 Parameters Table

N	Item*	Default	Range	Unit	Explanation
1	C=	2.00	0.00~10.00	%	Cs: Consistency Set-Point
2	n=	2	2,3,4,5, 6		n: Number of Node; n = 2: Linear Calibration; n=3~6 Multi-point Calibration of polygon-line **
3	C1=	0.00	0.00~ 20.00	%	C1: Consistency at Point 1 ***
4	d1=	0	0 ~ 4095		Ad1: AD at point 1 ***
5	C2=	10.00	0.00~ 20.00	%	C2: Consistency at Point 2
6	d2=	1000	0 ~ 4095		Ad2: AD at Point 2
7	C3=	0.00	0.00~20.00	%	C3: Consistency at Point 3(for Multi-Point Calibration)
8	d3=	0	0 ~ 4095		Ad3: AD at Point 3 (For Multi-Point Calibration)
9	C4=	0.00	0.00~ 20.00	%	C4: Consistency at Point 4(for Multi-Point Calibration)
10	d4=	0	0 ~ 4095		Ad4: AD at Point 4 (For Multi-Point Calibration)
11	C5=	0.00	0.00~ 20.00	%	C5: Consistency at Point 5(for Multi-Point Calibration)
12	d5=	0	0 ~ 4095		Ad5:AD at Point 5 (For Multi-Point Calibration)
13	C6=	0.00	0.00~ 20.00	%	C6: Consistency at Point 6(for Multi-Point Calibration)
14	d6=	0	0 ~ 4095		Ad6: AD at Point 6 (For Multi-Point Calibration)
15	PU1=				PW1: Password 1 = 1234, for changing Item 1-14
16	PU2=				PW2: Password 2 = 6789, for changing Item 17-34
17	L=	15	5 ~ 60	S	T: Cycle, the Output Delay Time (second)
18	P=	50	0 ~ 100	%	P: Proportion, the Proportion of Regulation. (Ratio multiplier)
19	Pd=	20	5 ~ 40		Pd: Proportion Divisor, the internal parameter.
20	CE0=	0.02	0.00~ 0.10	%	E0: Tolerance of Dead-zone, No control as Consistency Deviation is no more than this value
21	LOC=	0	0, 1		Lock: Choice of Start Mode 0: Measurement Mode; 1: Auto Mode
22	UOP=	0	0,1 ~ 6000		Vopening: Valve Initial Opening (or Opening Remembered). 0: Disable; 1: Enable
23	nAU=	4	1,2,4,8,16	S	nav: Digital filter or Damping time (second)
24	UL=	1	0 , 1		VV_lsm: The Normal State of Valve Limit Switch, 1: Normal On; 0: Normal Off
25	Ud=	100	3 ~ 6000	0.01S	T_step: Manual Control Stepping Time Ud = 100 (as 1.00 second)

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26	bL=	20	0 ~ 500	0.01S	backlash: Compensation of valve backlash bL = 20 (as 0.20 second)
27	0_4=	0	0 , 1		is0_4ma: Choice of Current Output lower limit 0/4mA 0: Output [0-20 mA], 1: Output [4-20 mA]
28	AdL=	200	0 ~ 4095		adl: Minimum Output Current 0mA/4mA at this AD
29	AdH=	4095	0 ~ 4095		adh: Maximum Output Current 20mA at this AD
30	P2d=				P2D: password = 3960, Restore all the parameters into the System Default
31	InP=	0	0 , 1		inp: Choice of Consistency Signal Channel, 0: 4/20mA Current Signal Channel; 1: RS485 Data Communications Channel
32	PU3=				PW3: Password 3, Reservation
33	PU4=				PW4: Password 4, Reservation

Remark:
* Parameter: Showing at the first line of LED of Handing Terminal at Parameter Input Mode.

** Linear Calibration (For 2-Point Calibration), n = 2.
(For Multi-point Calibrate) n can be 3,4,5,6.

*** Consistency value of Calibration points is from the sample test, and the AD are showing in the second line of LED of Handing Terminal at **Measurement** Mode.

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Scanning Additional Functions of Updated Consistency Controller

Automatic Mode Lock: system will lock automatically after 10 seconds under **Automatic Mode**, and then keyboard will be locked. And the decimal point displayed at the first row of LED flashes continually. Please Unlock to restore keyboard before switching.

Unlock the keyboard: Press button "↓" for more than 2 seconds to unlock the keyboard until decimal point displayed at the first row of LED stops flashing. The system can switch from **Automatic** to **Parameter**/**Measurement**/**Manual**.

Parameters modification: The Parameter name(first row of LED) flashes continually after pressing Button **ENTER**, otherwise press the button again to confirm the parameter is modified.

Choice of Start Mode: LOC=0, **Measurement Mode**; LOC=1, **Automatic Mode**. The original setting (default) is **Measurement Mode**.

Valve initial Opening (or Opening Remembered):
UOP=0, valve initial opening function is disabled; UOP=1,enabled.
To speed up the adjustment (reducing adjustment time), you can change the UOP default value from 0 to 1 to start Valve Initial Opening (or Opening Remembered) after installation & commissioning (setting correct parameters such as proportion, cycle, and system running stable). When Valve Initial Opening (or Opening Remembered) is enabled, the valve opening at first time can not follow the PID, it should be calculated based on the opening remembered value,Valve opens to the position remembered, and then adjust to the right position according to PID calculation, this can shorten the regulation time.

New Parameter Setting: Set LOC and UOP as 1 after installation & commissioning. The default of both parameters in the factory is 0.

The subsidiary function of Decimal Point Flashing: The Flashing of decimal point indicates System OK.

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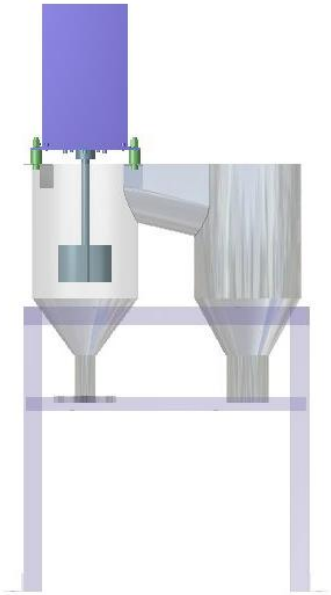
INTRODUCTION :

MOR200 Pulp Consistency Regulation System consists of Outer Rotary Measurement System (MOR200 Consistency Transmitter), Digital Regulation System and Electrical Regulation Valve.

MOR200 Consistency Transmitter

Outer Rotary Consistency Measurement System:



MOR200 Outer Rotary Paper & Pulp Consistency Transmitter is stable and reliable against different fiber ingredient, beating, filling, flow speed and pressure etc.

With its special design, it greatly reduces the influence of friction of the rotating mechanism and vibration of the environment with high resolution.

Its sensitive elements are structured into S-shape wide blade to access resistance signal greatly as the Pulp rotary. This structure is good at reducing the pulp sticking onto the blade and wrapping around the blade.

It is driven by synchronous motor with stable rotating speed and no affection from voltage fluctuations of power supply. It is much more accurate and reliable than other indirect measurements because it measures the resistance torque caused by blade rotary in the pulp directly. Signal is filtered and averaged by high-speed digital chip, which completely eliminates the influence caused by environment mechanical vibration, and electromagnetic field interference etc.

BR01 Consistency Transmitter :

BR01 Consistency Transmitter is updated based on MOR200, its electronic processing module is a greatly integrated and reliable SOC digital chip with high speed, its sample chip is a 24bits digit high precision ADC, and its I/O module is isolated and powerful against high frequency interfere, The temperature interference is very small.

Its output either is analog signal (0/4~20mA current signal / 4 wire system: ADC→digital processing→DAC→isolation module) , or digital signal (RS485, which can connect with BAORUN terminal, BAORUN BRA controller, as well as a PC, but need a RS485/232 converter and communications software .

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Digital Regulation System

MOR200_BRA Paper & Pulp consistency Controller:

MOR200_BRA Paper & Pulp Consistency Controller is the updated device based on MOR200_CU with more new functions. Its electronic processing module is a greatly integrated and reliable SOC digital chip with high-speed and anti-interference ability.

Host: including Measurement Process Unit and Control Circuits.

Terminal: Set up and display parameters for host, connect with host by RS485, which can communicate for long-distance.

Usage of Digital Regulation System:

The Digital Regulation System is composed of Host and Terminal, They are communicated over RS485, and it is available for long distance communications. All of operation are processed through the terminal, but it is only an input and display terminal, host operates independently. Measurement system, Regulation valve and Terminal are connected to the host through the cable, control signals are sent by the host.

Terminal:

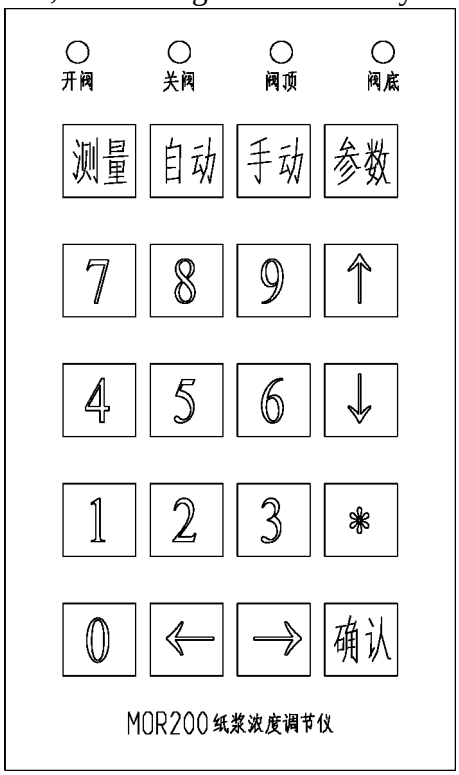
Display:

Two rows of LED, 4 for each row.

Another 4 auxiliary LED for status: Valve Open, Valve Close, Valve Open Completely, Valve Close Completely.

Keyboard:

20 buttons, 4 for mode, 10 for figure, and 6 for function.



Layout of the keyboard

Top four(indicator): Valve Open, Valve Close, Valve Open Completely, Valve Close Completely.

Second four(Mode Key): **Measurement**, **Automatic**, **Manual**, **Parameter**.

ENTER(确认)

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Press **Measurement**: LED at the top-row display consistency measured, LED at the bottom row display AD. System calibration shall be at **Measurement** mode to display the AD of pulp sample.
Press **Automatic**: LED at the top-row display consistency measured, LED at the bottom row display consistency set-point. LED at the bottom row flash continually. Controller controls consistency through PID method, to regulate valve automatically and try to stable the consistency at Set-point.
Press **Manual**: LED at the top-row display consistency measured, LED at the bottom row display accumulative time of valve opening (Incremental Value, could be cleared at any time by holding key of * for 2 seconds). For valve open /close manually, must be at **Manual** mode. The Calibration, consistency regulation, valve closing and so on may be operated at **Manual** mode.
Press **Parameter**: LED at the top-row display parameter item, LED at the bottom row display current parameter value (or input value). All of parameters are modified or browsed at **Parameter** mode. To avoid modifying (modifying by mistake) parameters unconsciously, input the correct password before modification.

Digital Key ： 0,1,2,3,4,5,6,7,8,9 to input parameters.
Function Key ：
UP ↑： Forward (browsing) for parameter at **Parameter,** open valve at **Manual**.
DOWN ↓：Backward (browsing) for parameter at **Parameter**, close valve at **Manual**
AUXILIARY ＊ ： Erase the number input and re-input again at **Parameter**; Stop the valve action(close/open) at **Manual**
ENTER (确认) ： Modification of Parameter is accepted after pressing **ENTER**.

Equivalence: ← = ↑ ; →= ↓

	Mode			
	Measurement	**Automatic**	**Manual**	**Parameter**
LED display at the first row	Consistency Measurement	Consistency Measurement	Consistency Measurement	Parameter Item
LED display at the second row	AD	Consistency Set-Point	Accumulative Time of valve opening	Parameter Value/Input
Display property	No LED flashing	4LEDs@2row flashing	1LED@2row flashing	No LED flashing

		Function Key			
		↑	↓	＊	确认
Function	Manual Mode/ press&hold 2s	Valve Open / Open Completely	Valve Close / Close Completely	Stop/ Clear	
	Param. Mode	Look forward	Look backward	Erase input	ENTER

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Parameter Modification Procedure :

For example: Modify consistency set-point to be 2.50 .

Check **MOR200 Parameters Table**, the parameter item of consistency set-point is **C=** . System switches to **PARAMETER** mode as pressing **PARAMETER(参数)**, it is available to modify or browse all parameters. The first parameter displayed is **C=** (the LED at first row display parameter item/name, LED at second row display current consistency set-point). Check parameter backward by pressing ↓ and forward by pressing ↑ the parameter . Checking sequence is corresponding with No in the **Parameters Table**. The current displaying parameter can be modified.

In order to avoid modifying parameters by mistake, input 1st –level Password (parameter name:**PU1=**) before modifying parameters at mode **PARAMETER**. Pressing ↓（or pressing ↑）to check the parameter PU1=, if it is 8888, it is locked. Input password (1234) to unlock.

Method: Press Keys **1234** , LED at the second row displays input, press * to cancel the input if input the wrong number, and input the correct number again.

Press **ENTER(确认)** to finish this input if it is correct. If the password entered was correct, **PU1=1111** (LED at the second row change to **1111** from **1234**), the user parameters is available to be modified.

Then use ↓↑ to move to parameter **C=** , input figure 250 (because the consistency is displayed as decimal while input as integer, input 250 and display 2.50), finally press **ENTER(确认)** the parameter is modified, displaying **C=2.50**. If input is beyond the Parameters Range, the parameter will be up to the maximum and minimum.. For example, the range of consistency set-point is (0.00~10.00), if input 15.00, C=10.00.

As long as at **PARAMETER** mode, it is available to modify other parameters with same procedure. The result must be preserved after modification, and the parameter modified must be into **EEPROM,** so even if the power off, parameters will not missing. As long as you switch from **PARAMETER** mode to other modes, the parameters will be automatically written into the EEPROM for permanent preservation.

For example, at current **PARAMETER** mode, and some parameters have been modified, press **MEASUREMENT** to enter into MEASUREMENT mode, these revised parameters will be automatically written into the EEPROM**,** the LED at first row will flash twice, it is correct. Otherwise it is wrong if the LED at first row flashing continuously.

Remark: As browsing parameters with ↓↑, parameter sequence is head-tail connected, it is arranged to be circular.

User parameters are consistency set-point and calibration node coordinates, they are often modified during the operation, the other parameters, such as system cycle, proportion, regulating valve etc, are fixed after installation and commissioning. Therefore, they are classified as system parameters, for user not modify them, and another password **(PU2=)** needed to identify it before modification.

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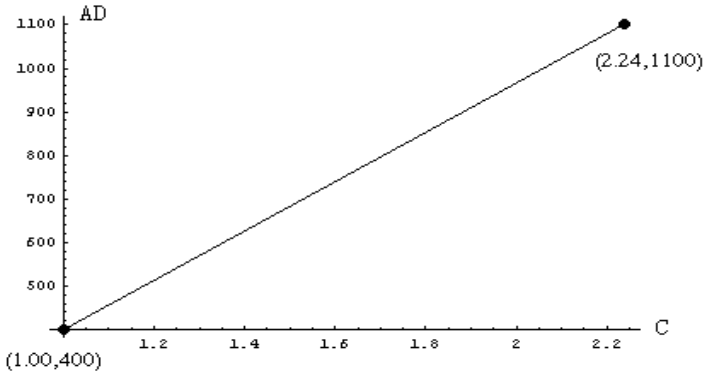
Calibration Procedure :

Simple calibration, linear calibration, can be 2-points with 4 data:
(C1, Ad1), (C2, Ad2). Relationship between pulp consistency C and AD of measurement system are not linear, the linear calibration is only approximately indicating, there is error between consistency measurement and the real value. In order to reduce calibration error, these two points for linear calibration should be around of consistency set-point closely.
Multiple-points calibration is of 3 to 6 points, trying to close to accurate curve with polygon-line, which can further reduce the calibration errors. However, the errors caused by calibration is a fixed valve, it has few influence on control system.
The following examples showing the calibration process:

For example: 2-Points Calibration, the coordinates are (1.00, 400), (2.24, 1100)



两点标定，线性标定

(**2-Points Calibration**, Linear Calibration)

Revised parameters :
n=2
C1=1.00
d1=400
C2=2.24
d2=1100

Operation steps : pressing **PARAMETER(参数)** to switch to **PARAMETER** mode， the first parameter is displayed, consistency set-point **C=2.00**, LED at the first row display Parameter name **C=** ， LED at the second row display Parameter value **2.00**. Because 5 parameters are needed to be modified for 2-points calibration, input correct 1st –level password (**PU1=1234**) to unlock at first.

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The details showing are as following table.

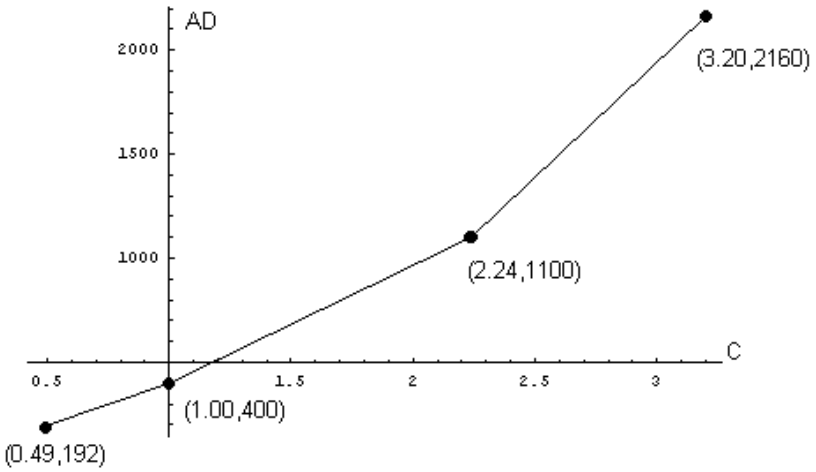
Key (Pressed)	Display	Data Input (Entered)	Display after Modification
Parameter （ 参数 ）	C=2.00		
↑	PU1=8888	**1234**	PU1=1111
↓	PU2=8888		
↓	C=2.00		
↓	n=2	**2**	n=2
↓	C1=0.00	**100**	C1=1.00
↓	d1=0	**400**	d1=400
↓	C2=10.00	**224**	C2=2.24
↓	d2=1000	**1100**	d2=1100
Measurement （ 测量 ）			

Remark: the bold in this table is the key to be pressed or data to be input. To make sure the data input correctly, check the data again after input, then press **Measurement (测量)** to exit from **Parameter(参数)** mode, then system will write the revised parameters to EEPROM automatically to preserve permanently, even power off the data will not lost, after power on, all of parameters will restore to the Memory automatically. (from EEPROM to Memory). Linear interpolation algorithm is used for 2-points calibration; it is inner-insert among these two points, otherwise, outer-insert beyond them. The two points (**C1, Ad1**) and (**C2, Ad2**) must be the different points. For 2-points calibration, Node number **n=2** must be correct. During browsing, the system will shield redundant nodes automatically, only the useful nodes parameters are displayed.

For example:

Four-points calibration: coordinates :

(0.49, 192), (1.00, 400), (2.24, 1100), (3.20, 2160) .



4点标定，多点折线标定

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Revised parameters ：
n=4
C1=0.49
d1=192
C2=1.00
d2=400
C3=2.24
d3=1100
C4=3.20
d4=2160
Operation steps: Four-point calibration is to modify the 9 parameters above, its process and method are same as 2-points calibration. At **Parameter(参数)** mode, find 1st –level password parameter (**PU1=**) at first, input the password (**1234**), then find more parameters to be modified, input the new data, check again to verify the input after parameter modification, input again if some are wrong. Exit **Parameter(参数)** mode (Press any one of rest 3 mode Keys, e.g. **Measurement (测量)**) after checkout, system writes the revised parameters into EEPROM automatically for preservation permanently. LED at the first row will flash twice as the parameters are written correctly.
However the node number **n** input must be correct, it is the number of calibration node. Any AD（d1,d2,d3,d4）can not be the same.
(Remark: as long as no same-node, its sequence is arbitrary).

Automatic control：

Press **AUTOMATIC**（自动）to Automatic Control Mode，LED at the first row display measurement of consistency, LED at the second row display consistency set-point and flash. At the Automatic Control Mode, the system will regulate consistency and stable it at the set-point through PID calculation. And the valve opening / valve closing indicator will light; this process is the process of valve action. Automatic control includes the dead-zone control, dead-zone tolerance is CE0= ， when the absolute value of consistency deviation is less than and/or equal to the bandwidth of dead-zone, system ignores this deviation, no control. The relative system parameters are: cycle, proportion, Proportion divisor, dead-zone tolerance, namely L= , P= , Pd= , CE0= . These parameters should be confirmed during the installation and commissioning of this system, and fixed during operation.

Manual control:

Press **MANUAL**（手动）to MANUAL control mode. Customer can easily open/close valve with Hand Holding Terminal. LED at the first row display consistency measurement to observe the consistency changes, LED at second row display accumulating time of valve opening (Time accumulator, plus time of valve opening, minus time of valve closing), and LED at the left side flashes. The time accumulated of the accumulator can be cleared at any time, holding **AUX** Key ＊for 2 seconds, LED at the second row to be zero. Press Key ↑**,** valve opens, the indicator of opening

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valve light. Press Key ↓**,** valve closes, the indicator of valve closing light. The time of opening valve/closing valve is the stepping parameter （ **Ud=** ）for each time, the time unit is 10ms (0.01s), for example, Ud=100 means every time pressing Valve **OPEN** ↑ / Valve **CLOSE** ↓ , time of valve opening / closing is 1s. If open valve completely, hold Key ↑ for two seconds. If closing valve completely hold key ↓ for two seconds. During the process of valve opening/closing, press **AUX** Key ∗ to stop opening /closing valve at any time.

Measurement mode:

Gain current AD value. Press **MEASUREMENT** to MEASUREMENT mode. LED at the first row display the consistency measurement, LED at the second row display AD from A/D Converter of the measurement system, it is 12 bits, its range is （0, 4095）. After filtering, the influence of such as mechanical vibration and electrical interference etc is eliminated.

For calibration, sample several groups of pulp with different consistency, for each group of pulp sample measure two data, one is its consistency percentage C of DW of pulp, and the other is its AD. The AD can be gotten at **MEASUREMENT** mode, consistency C should be from test. For simple calibration, 2-Points Calibration is ok with (C1, Ad1), (C2, Ad2) .

For calibrate precisely, need more data, even more to identify these data points (C1, Ad1), (C2, Ad2), (C3, Ad3),… (Cn, Adn) on the coordinates paper, then making polygon-line to approach (or fit) these coordinates points, using nodes of polygon-line for multiple-points calibration. Since electrical components of measurement system have some kind of temperate drift, to reduce the influence of temperature drift, system must be warmed up before measurement, normally read AD value after starting machine for 15 minutes, it is more accurate.

Interface Introduction :

Electrical connector introduction is showing refer to table:

Interface definition of consistency transmitter(BR01)

No	Type	Plug	Cable Length (m)(spe)	Definition of every core of plugs (color of wire)
1	MOR200 Transmitter (old type)	4	10m (4x0.3 S)	1: +24V(red), 2: GND(black), ← power input 3: 4-20mA Io(blue), 4: GND(white) ← 0-20mA output
2	BR01 Transmitter (new type)	4 **	10~15m (8STP)	1: +24V(Orange), 2: GND(OW), ← power input 3: I+(blue), 4: I-(BluW) ← 0-20mA output
3	BR01 Transmitter (new type)	5 ***	10~15m (8STP)	1: +24V(brown), 2: GND(BrnWht), ← power input 3: A(blue), 4: B(BluWht) ←RS485 Com 5: Suspended

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Interface definition of Consistency Controller(BRA)

No	Interface (Connected Objects)	Connector	Cable Length (m)(spe)	Definition of every core of cable
1	Power/~220V	2P	5m (2x0.5)	1: live (red), 2: null (black)
2	Electric regulate valve	3P	15m (6x0.3)	1: N (blue), 2: close valve(red), 3: open valve(green) ←220V AC
		6P		1, 2, 3:N/A, 4:COM(black), 5:open completely(yellow), 6: close completely(brown)
3	MOR200 Transmitter	4P		1: +24V, 2: GND, 3:Io(4-20mA), 4: GND
4	Term/RS485	5P	50/100m (4x0.2) /4core UTP	1:+24V(red), 2: GND(black), 3: A(yellow), 4:B(blue), 5: N/A /UTP: 1:+24V(Brn),2:GND(BrnWht), 3:A(blu), 4:B(BluWht),5:N/A
5 *	0/4-20mA	4P	1m (4x0.2)	1,2: N/A(suspended), 3: I+(Yellow), 4: I-(Blue) ← 0/4-20mA output

*: The consistency current signal output from controller is processed (filtering, multiple-point calibration), then output through DAC and isolated amplifier. The location of 4-core connector of current output is on the central of the controller.

Interface definition of Terminal

No	Interface (Connected Objects)	Connector REF	Definition of every core
1	RS485 Com	5P	1: +24V(red), 2:GND(black), 3:A(yellow), 4:B(blue), 5:N/A

** Electrical current output is 0/4-20mA , for 4-wire system.

Remark: If **MOR200_BR01** consistency transmitter is provided without **MOR200_BRA** controller which produced by **BAORUN**, and consistency is controlled by the third party (such as DCS connection), MOR200_BR01 only provides current signal (0/4-20 mA 4-wire). At the same time also provides one set of 4-core air-plugs and one socket.

*** Not every **MOR200_BR01** has a 5-core plug, if the equipment has a 5-core plug and not using RS485 communication temporarily, wrap this plug with insulated rubber fabric. The core 1 and 2 of plug of 5-core and 4-core are 24V DC power input, they are equal-potential (already made short-connecting interiorly, connect core 1 of 4-core and that of 5-core, connect core 2 of 4-core and that of 5-core), 24V power can be provided by plug of 4-core or 5-core .

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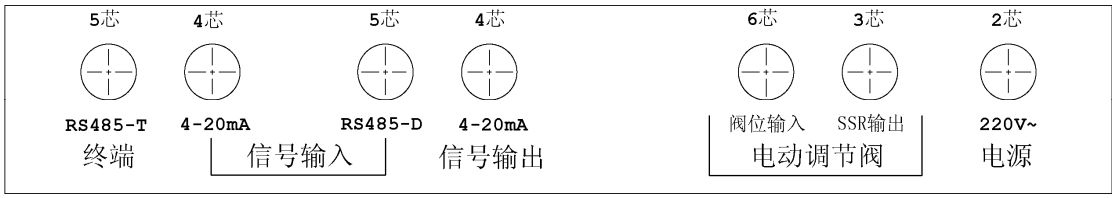
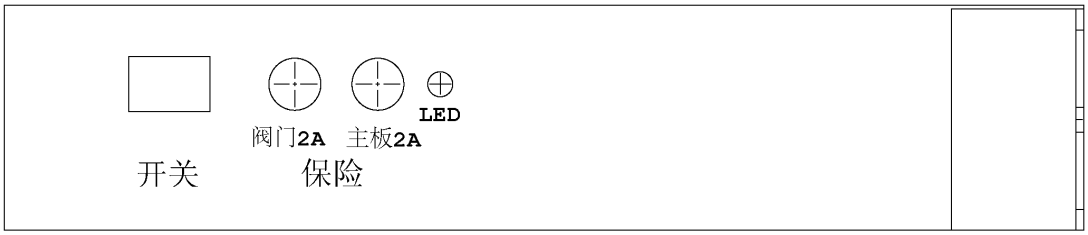


Outline of Air-plug of **MOR200-CU** Pulp Consistency Regulator

终端：Terminal
信号输入：Input
信号输出: Output
电动调节阀：Electrical Regulation Valve
电源：Power
阀位输入：Valve Position Input
芯: Core



Location of power switch and fuses

开关：Switch
阀门：Valve
主板：Mainboard
保险：Fuses

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