

Installation & Operating Instructions

**Series 5131-007X
"Smart-Bloc II-S"®
Liquid Level Controllers**

Created 10/29/96

Kinematics & Controls Corporaton

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INTRODUCTION.

Kinematics', Series 5131-007X "Smart"-Blocs are low-power, microprocessor-based, level sensor signal amplifier/controllers. They are intended for use ONLY in conjunction with *Crouse-Hinds*, low impedance Zener Barriers, Model #SB49140M1250, working with Kinematics', "BASIC" output, single point, optoelectronic liquid level sensors.

This manual covers the installation and operating features of the following "Smart Blocs".

P/N	5131-0074	"Smart-Bloc II-S"®	115V.-50/60 Hz.(Input)
P/N	5131-0075	"Smart-Bloc II-S"®	230V.-50/60 Hz.(Input)
P/N	5131-0076	"Smart-Bloc II-S"®	9-28 V.D.C. (Input)

All models are designed to:

1. Accept the appropriate voltage input;
2. Provide D.C. power to Kinematics' single point, optoelectronic, liquid level sensors.
3. Receive their return signals as microprocessor inputs.
4. Provide "dry" contacts power output, and in the case of the D.C. models, appropriate fault indication signaling, to the "outside world" in accordance with the selected mode of operation.

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SPECIFICATIONS.

Microprocessor "Signetics" 87C752 or Equiv.
Module Size 1.16"W. X 3.12"D. X 2.72"H.
Mounting D.I.N Rail or Flush Mounting.
Input Voltage Standard, 9-28 Volts D.C.
Optional, 115 Volt, 50/60 Hz.
Or, 230 Volt, 50/60 Hz.
Output Dry Contacts (1 Form A), 10 Amp. @ 250 V.A.C., 30 V.D.C.
Fault Output Dry Contacts (1 Form A), 1 Amp. @ 250 V.A.C., 30 V.D.C.
Power Consumption 25 ma. (Avg.), 50 ma. (Max.)
Operating Temperature Range (-)20°C To (+)80°C.

FEATURES.

- **Adjustable Threshold.** Two, 12-turn potentiometers on each "Smart"-Bloc II-S provide the user the means for fine tuning each sensor in the system.
- **User Selectable Modes.** The user selectable options include selection of operating "Mode", i.e. Sensor normally "Wet" or normally "Dry"; Time Delay on "Make" only; Time Delay on "Break" only; Time Delay on both "Make" and "Break"; No Time Delay; "Pump-Up"; "Pump-Down" and Sensor Disable.
- **Ambient Light Immunity.** "Smart"-Bloc II-S controllers provide a controlled current/voltage pulsed D.C. input to the sensor when used in conjunction with the specified model, *Crouse-Hinds* Zener barrier (See *Introduction*, Page 2), and a filtered receiver/amplifier circuit, for virtual immunity to false triggering by incident ambient light.
- **Continuous Fault Monitoring.** A fault monitoring algorithm continuously monitors the condition of each sensor, and reports any faulty or non-functional sensor immediately upon it's detection.
- **L.E.D. Indicator.** Face mounted L.E.D. provides visual indication of the status of the relay and/or any sensor fault.
- **D.I.N. Rail Mounting.** Universal mounting on any of three D.I.N. rail styles.

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USER SELECTABLE OPTIONS.

Both channels of all "Smart-Bloc II-S"® models are user programmable by selecting an appropriate position on each of the two hexadecimal rotary DIP switches. The switch actuators are accessible through the center holes in the front face of the panel. Eight *Independent* operating modes and two *Dual* modes are provided in each "Smart-Bloc II-S"®. One position of each Hex switch disables the sensor connected to that channel.

MODES OF OPERATION

• **Independent Modes.** "Smart-Bloc II-S"®, controllers can control the output of either one or two sensors, each totally independent of the other. When using the "Smart-Bloc II-S"® with two sensors in any of the *Independent* modes, both sensors may be in one tank, or they may be installed in different tanks. The eight *Independent* modes are defined below.

<u>HEX</u>	<u>FUNCTION</u>
"0"	Normally "Wet" (Energize when dry), 0 Sec. Delay "Make", 0 Sec. Delay "Break".
"1"	Normally "Wet" (Energize when dry), 0 Sec. Delay "Make", 5 Sec. Delay "Break".
"2"	Normally "Wet" (Energize when dry), 5 Sec. Delay "Make", 0 Sec. Delay "Break".
"3"	Normally "Wet" (Energize when dry), 5 Sec. Delay "Make", 5 Sec. Delay "Break".
"4"	Normally "Dry" (Energize when wet), 0 Sec. Delay "Make", 0 Sec. Delay "Break".
"5"	Normally "Dry" (Energize when wet), 0 Sec. Delay "Make", 5 Sec. Delay "Break".
"6"	Normally "Dry" (Energize when wet), 5 Sec. Delay "Make", 0 Sec. Delay "Break".
"7"	Normally "Dry" (Energize when wet), 5 Sec. Delay "Make", 5 Sec. Delay "Break".
"F"	Sensor Disable.

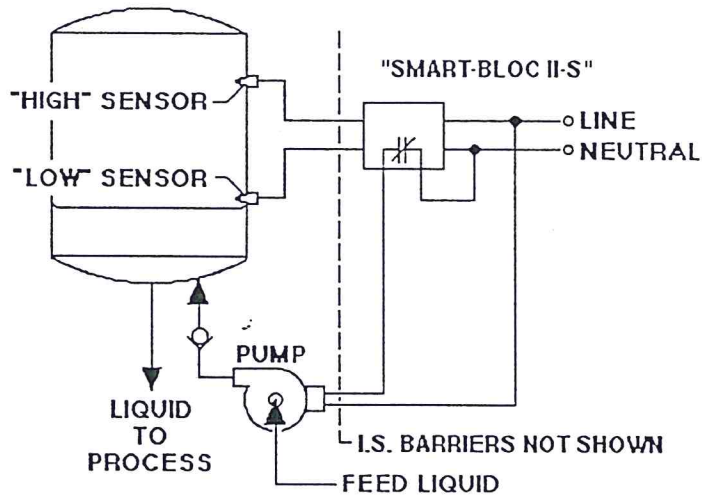
In any of the *Independent* modes, the "FAULT" relay contacts will close when either sensor experiences a failure or a fault.

• **Dual Modes.** Although "Smart-Bloc II-S"® controllers will support a single sensor or sensors working independently on either or both channels, their elegance lies in their ability to process the two sensor inputs, and to provide a single output signal based on their combined states. Two "Dual" mode are provided for this purpose. These two additional modes, "Pump-Up" (Hex "D") and "Pump-Down" (Hex "E"), are described below.

Continued...

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Pump-Up Mode. The Pump-Up control mode is chosen when it is desired to maintain a constant level between two points in a process tank, and the process is normally depleting liquid from the tank. In this mode, the controller's output relay contacts are closed only when both sensors are dry, and are open only when both are wet. The schematic below best describes this mode.

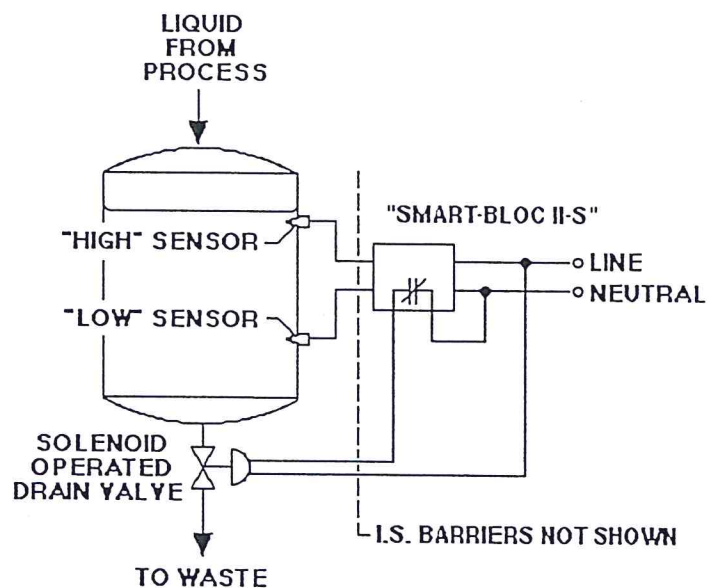


On power-up, both of the sensors are dry. Consequently, the controller's output relay contacts close to start a pump or open a "fill" valve. The liquid flows into the tank until its level rises to a point above the upper sensor. Now both sensors are wet, and the relay contacts open, stopping the pump. When the process causes the liquid level to fall below the lower sensor, both sensors again become dry, and the filling action restarts to restore the liquid to the higher level.

Continued...

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Pump-Down Mode. The Pump-Down control mode is chosen when it is desired to maintain a constant level between two points in a process tank, and the process is normally adding liquid to the tank. In this mode, the controller's output relay contacts are closed only when both sensors are wet, and are open only when both are dry. The schematic below best describes it's operation.



On power-up, the tank is empty and both sensors are dry. The output relay contacts, therefore, are open, and no action occurs. As the process fills the tank, it's level rises to the point where eventually both sensors are wet. The relay contacts now close, and a "waste" pump starts or a "drain" valve is held open until the level in the tank drops to a point below the lower sensor. When the level reaches the point where both sensors are again dry, the relay contacts open and the draining action stops. When the process again causes the level to rise above the upper sensor, and both sensors are again wet, the draining action resumes to drop the liquid to a point below it's lower level.

• **Sensor Disable.** The user may totally disable the single sensor at any time. This is useful in temporarily silencing alarms from faulty sensors. Whenever a sensor channel within a larger system is not being utilized, it should be disabled to prevent a constant FAULT condition from being reported.

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INSTALLATION & SETUP PROCEDURE.

Refer to the diagrams and tables referenced in each paragraph below, and follow these simple steps for quick and easy installation.

1. **Fasten the "Smart-Blocs" in place.** "Smart-Bloc II-S"® controllers are to be installed in an appropriate panel box. The box *must* be located in a non-classified (*safe*) area. "Smart-Blocs" are D.I.N. rail mountable. Each is shipped with a small segment of perforated 35 mm. D.I.N. rail to allow flush mounting in systems which do not use a D.I.N. rail mounting system. Remove and discard this small segment of D.I.N. rail for direct mounting into panels which already have a D.I.N. rail system installed.
2. **Install the Zener Barriers.** Zener barriers should also be installed in a *safe* area, near the "Smart-Blocs". Follow the barrier manufacturer's instructions for proper installation.
3. **PROPERLY CONNECT ALL BARRIERS TO AN APPROPRIATE I.S. GROUND!**
4. **Connect the Sensors to the Barriers.** Each of the four sensor leads of every sensor must be connected to a discrete channel of a Zener barrier. Therefore, two, dual-channel barriers will be required for each sensor in the system. Refer to the schematic diagram shown on page 11 of this manual.
5. **Connect "Smart-Blocs" to the Barriers.** Again refer to the schematic diagram shown on page 11. Also please refer to the Terminal Configuration Table shown on Page 13. Note that sometimes not all of the terminal positions on the "Smart-Bloc" are utilized. **If you refer to the label on the side panel of the "Smart-Bloc" for assistance, note that the I.S. barriers are not shown.**

Caution! Double check all sensor and barrier connections **before** applying power to the "Smart-Bloc"® Controllers. Improper connection **will** damage or destroy the sensors. Never connect or disconnect sensors while there is power applied to the controller.

6. **Connect outputs.** Connect the relay output to its respective device or P.L.C. Again, refer to the table on page 13, or to the schematic on page 11.
7. **Connect power.** Connect the "Smart-Bloc" to a proper power source. Double check the rated voltage of the model number you are installing. See page 2. Again, refer to the table on page 13, or to the schematic on page 11 for the proper power input terminals for A.C. and D.C. models.

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8. **Calibrate the Sensor.** Calibrate each sensor/channel independently. First, set the mode selection switch to Hex position "4" for both channels. Immerse the sensor to be calibrated in the working fluid and apply power. (See step 5. below.) If the "Status" L.E.D. for that channel is "OFF", slowly turn the potentiometer counter-clockwise until the L.E.D. just turns "ON", then continue in the SAME direction for another 1/2 to full turn. The sensor is now properly calibrated.

If, however, the "status" L.E.D. is "ON", slowly turn the potentiometer clockwise until the L.E.D. turns "OFF". Now turn it slowly back in the counter-clockwise direction until the L.E.D. just turns "ON", then continue in the same direction for another 1/2 to full turn. The sensor is now properly calibrated.

Now, calibrate all other sensor/channels in the system.

If turning the potentiometer full range in both directions fails to evoke a change in the status of the related L.E.D., consult the factory for technical assistance.

9. **Program the Module.** After calibration, remove power and select the desired mode of operation by positioning the Hexadecimal rotary D.I.P. switch to the desired setting. See User Selectable Options above on page 4 above. Or, refer to the summary table on page 9 below, or on the side panel label of the "Smart-Bloc"® itself.

10. **Your installation is now complete!** Test for proper operation.

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TABLES.

Summary of User Programmable Functions, "Smart-Bloc II-S®
(Hexadecimal Rotary D.I.P. Switch Settings)

"Smart-Bloc II-S"®. "Smart-Bloc II-S"® controllers have two sensor channels. When the face of the controller is viewed with the red L.E.D. at the bottom and the pot at the top, Channel 1 is the left hand channel. Channel 2 is on the right hand side. When using "Smart-Bloc II-S"® controllers with sensors which are to function independently, both Channel 1 and Channel 2 Hex switches must be set to the mode desired for each sensor.

"Dual" mode settings are made ONLY on Channel 1 for BOTH sensors. Selection of either of the "Dual" modes on Channel 1 will override any selection made on Channel 2, except for Hex "F", "Sensor Disable".

Disabling Channel 2 will allow a sensor on Channel 1 to function in any of the "Independent" modes. Similarly, disabling Channel 1 will allow a sensor on Channel 2 to function in any of the "Independent" modes. However, if Channel 2 is disabled with one of the "Dual" modes selected on Channel 1, both sensors will be disabled.

Table 2. "Smart-Bloc II-S"® Programmable Functions

Channel 1 (Left)				Channel 2 (Right)			
Hex	"Make" Relay	<----Time Delay ---->		Hex	"Make" Relay	<----Time Delay ---->	
		On "Make"	On "Break"			On "Make"	On "Break"
"0"	Dry	0	0	"0"	Dry	0	0
"1"	Dry	0	5	"1"	Dry	0	5
"2"	Dry	5	0	"2"	Dry	5	0
"3"	Dry	5	5	"3"	Dry	5	5
"4"	Wet	0	0	"4"	Wet	0	0
"5"	Wet	0	5	"5"	Wet	0	5
"6"	Wet	5	0	"6"	Wet	5	0
"7"	Wet	5	5	"7"	Wet	5	5
"8"	Unused	Unused	Unused	"8"	Unused	Unused	Unused
"9"	Unused	Unused	Unused	"9"	Unused	Unused	Unused
"A"	Unused	Unused	Unused	"A"	Unused	Unused	Unused
"B"	Unused	Unused	Unused	"B"	Unused	Unused	Unused
"C"	Unused	Unused	Unused	"C"	Unused	Unused	Unused
"D"	Pump UP	0	0	"D"	Unused	Unused	Unused
"E"	Pump DOWN	0	0	"E"	Unused	Unused	Unused
"F"	<----- Sensor Disabled ----->"F" <----- Sensor Disabled ---						

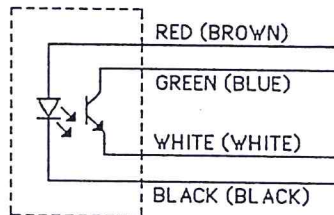
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COMPATIBLE SENSOR STYLES.

Only one style of Kinematics' optoelectronic liquid level sensor is recommended for use with these "Smart-Bloc II-S"® controllers & the recommended Zener barrier. It is the Style "B", four-wire, single-point sensor shown below. Note that this style of sensor may have alternate color schemes for the wiring.

STYLE "B"
SINGLE LEVEL SENSOR
(4 WIRE)

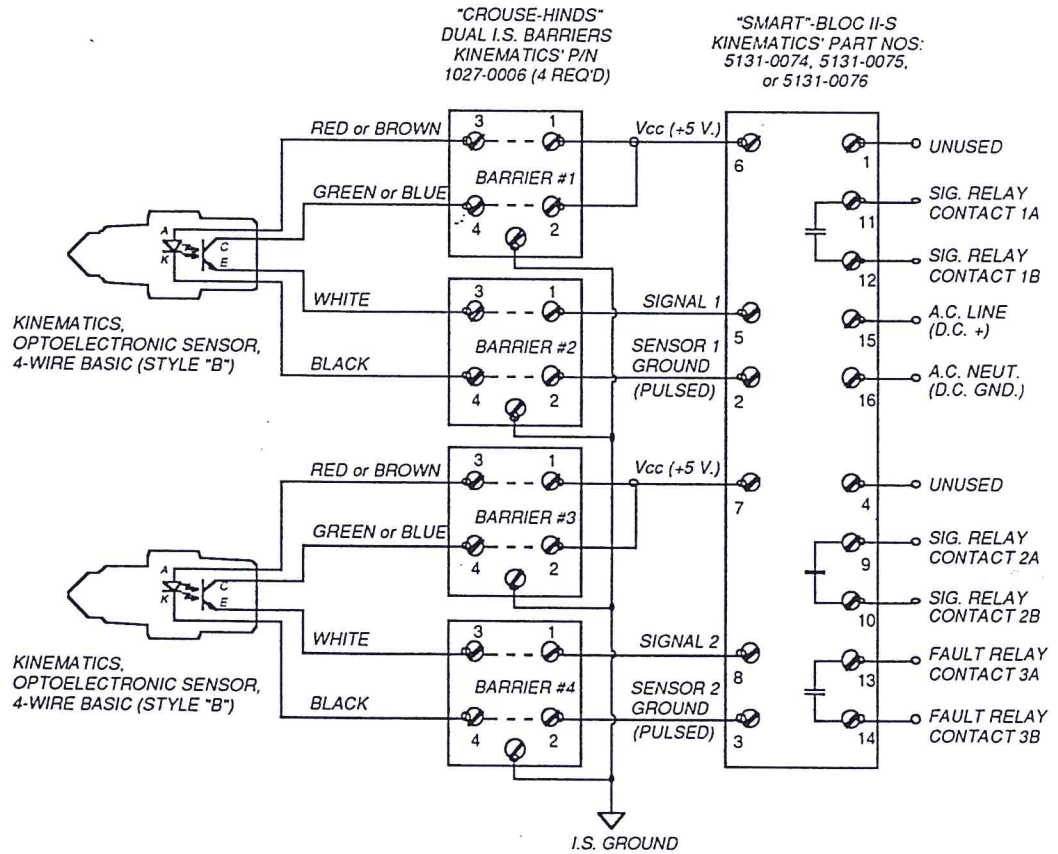


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SENSOR & BARRIER CONNECTIONS.

All Kinematics' Style "B" optoelectronic liquid level sensors are connected through the Zener Barriers to "Smart-Bloc II-S"® as shown below. Always "Disable" any sensor channel not being utilized to avoid the possibility of false signaling.

General Connection Scheme
SMART-BLOC II-S® CONTROLLERS



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OUTPUT CONNECTIONS.

Power Outputs.

"Smart-Bloc II-S"® controllers each have two (2), 1 Form A, relay outputs. Contact rating for both relays is 10 Amps. @ 250 V.A.C., 30 V.D.C.

When the "Smart-Bloc II-S"® controller is operating in any of the *Independent* modes, the output relay contacts for sensor #1 are across terminals 11 & 12. Those for sensor #2 are across terminals 9 & 10.

When operating "Smart-Bloc II-S"® controllers in one of the two *Dual* modes, both relays operate together as a 2 Form A relay, still at terminals 9-10 & 11-12. In this mode, either or both sets of contacts may be used for a single output.

Furthermore, in any the *Independent* modes, the state of each relay may be observed at the status L.E.D.'s on the front face of the "Smart-Bloc". Status L.E.D.'s are "OFF" when the associated relay contacts are "OPEN", and "ON" when they are "CLOSED".

However, when the controller is operating in one of the *Dual* modes of operation, the L.E.D.'s serve *only* to indicate whether a particular sensor is "WET" or "DRY". If a sensor is "WET", it's L.E.D. will be "ON", If it is dry, the L.E.D. will be "OFF".

Therefore, in the "Pump-Up" mode (Hex "D"), both L.E.D.'s will be "OFF" when the output relay contacts are closed. In the "Pump-Down" mode (Hex "E") both L.E.D.'s will be "ON" when the output relay contacts are closed.

Fault Output.

"Smart-Bloc II-S"® controllers have a 1 Form A fault output relay whose contacts will close whenever the microprocessor detects a "FAULT" condition at *either* one of the connected sensors. "Fault" relay contacts are rated at 1.0 amp. Outputs for fault signaling are located at terminal positions 13-14. Connect these points to an appropriate annunciator, signal lamp or PLC.

Local Fault Indication.

The status L.E.D. will blink in the event of a sensor failure, a broken wire or an incomplete connection. The feature is functional on both A.C. and D.C. versions of "Smart-Bloc II-S" ®

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Terminal Configurations, "Smart-Bloc II-S"®

1. UNUSED
2. SENSOR #1, GND. (Pulsed)
3. SENSOR #2, GND. (Pulsed)
4. UNUSED
5. SIGNAL, SENSOR #1
6. SENSOR #1, Vcc (+5 VDC.)
7. SENSOR #2, Vcc (+5 VDC.)
8. SENSOR #2, SIGNAL
9. SIG. RELAY CONTACT #2 (10 A.)
10. SIG. RELAY CONTACT #2 (10 A.)
11. SIG. RELAY CONTACT #1 (10 A.)
12. SIG. RELAY CONTACT #1 (10 A.)
13. FAULT RELAY CONTACT (1.0 A.)
14. FAULT RELAY CONTACT (1.0 A.)
15. A.C. LINE/(+V.D.C.)
16. A.C. NEUTRAL/(D.C. Ground)

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SUPPORT.

Kinematics & Controls Corporation provides full technical support for its products. If you need assistance with any problem, please call us **Toll-Free at 1-800-833-8103**. Ask for technical support. From outside the Continental U.S.A., please call 516-595-1803.

WARRANTY.

All equipment described herein is warranted to the original purchaser for one year from the date of purchase to be free from defects in material and workmanship, but not against damages caused by misuse, negligence, accident or faulty installation. When the equipment is installed and operated in accordance with factory recommendations and instructions, Kinematics & Controls Corporation will repair or replace free of charge any part of the equipment found to be defective, upon prepaid return of the part to the factory during the warranty period. In no event shall any liability or obligation of Kinematics arising from this warranty exceed the purchase price of the equipment.

All other warranties, whether expressed, implied or statutory such as warranties of merchantability or fitness for a particular purpose, are hereby excluded and disclaimed to the extent that they exceed the warranties expressly granted in this clause. In no event shall Kinematics be liable for consequential or incidental damages.

IMPORTANT NOTICE TO THE PURCHASER.

All statements, technical information and recommendations are based on tests we believe to be reliable, but the absolute accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties expressed or implied.

Seller's and manufacturer's only obligation shall be to replace such quality of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential arising out of the use or the inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith.

No statement or recommendation shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.



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