Kcm-7pr Intelligent Pid Pressure Controller User Manual

⚠ SAFETY INFORMATION

WARNING — RISK OF ELECTRIC SHOCK: Disconnect and lock out all electrical power sources before making or altering any electrical connections. Failure to do so may result in severe electrical shock, personal injury, or death.

CAUTION — EQUIPMENT DAMAGE HAZARD: Before applying power, verify that the supply voltage matches the rating on the controller. Install and wire the controller in accordance with applicable electrical codes and the equipment manufacturer's requirements.

WARNING — OVERPRESSURE HAZARD: Do not rely on this controller as the sole means of overpressure protection. Provide an independent high-limit shutdown and other protective devices as required by the process design and applicable codes.

I. Overview

The KCM-7PR Series is a PID pressure controller for industrial process applications. Its four-key interface and two four-digit LED displays allow operators to monitor the process variable (PV) and setpoint (SP).

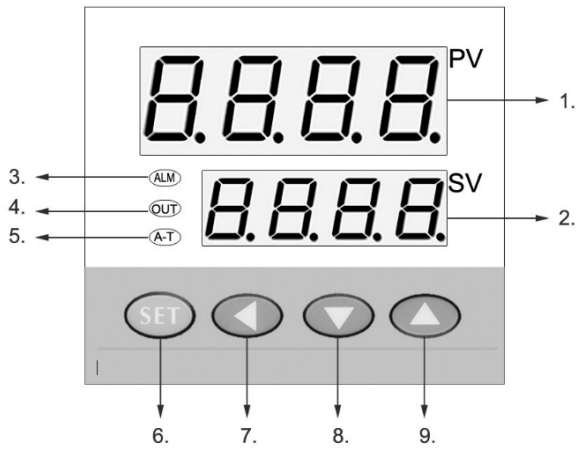
The controller provides a fast-response PID mode for sensitive pressure processes and a lag-compensation mode for processes with significant delay. Applications include pressure control in machinery, chemical processing, plastics extrusion, and nonwoven fabric production.

II. Technical Specifications

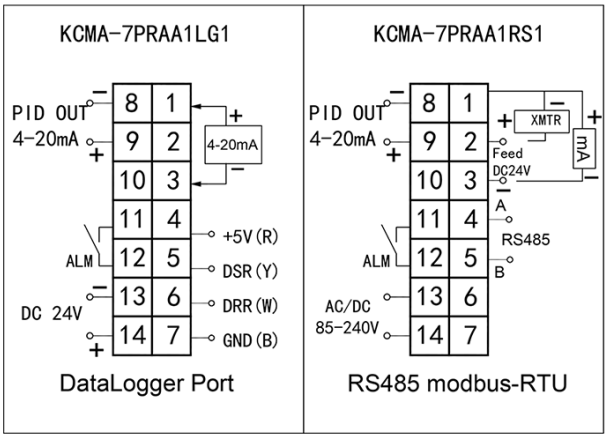
1. **Measurement Accuracy:** ±0.5% of Full Scale (F.S.) ±1 digit
2. **Sampling Interval:**20ms
3. **Supported Inputs (Select one per model):**
   4–20 mA DC or 0–10 VDC analog input. Confirm the input type for the controller model.
4. **Control Output (Hardware Dependent):**
   - 4-20mA / 0-10mA Analog Signal
   - Relay Contact (220 VAC, 3A resistive load)
   - Solid State Relay (SSR) Drive Voltage
5. **Power Supply:** 85-242 V AC/DC (universal switching), 50/60Hz or Low-Voltage Option: 24 VDC
6. **Communication (Optional):** RS232/485 serial port with standard Modbus-RTU protocol
7. **Operating Environment:** 0 to 50.0°C (32 to 122°F), relative humidity ≤ 85%, in an area free from corrosive gases and strong electromagnetic interference.

III. Front Panel and Wiring

Front Panel



Wiring Diagram



Disclaimer: The wiring diagram is for reference only. Always verify connections against the terminal markings on the physical unit.

1. **PV Display:** In normal operation, shows the measured process value. In parameter setting mode, shows the parameter symbol.
2. **SV Display:** In normal operation, shows the setpoint value. In parameter setting mode, shows the parameter's configured value.
3. **ALM Indicator:** Illuminates when the alarm relay is energized.
4. **OUT Indicator:** Illuminates when the main control output is energized.
5. **A-T Indicator:** Indicates stabilization band and tuning status:
   Steady ON: Process pressure is stable and locked within the configured stabilization tolerance band.
   Flashing: Process pressure has drifted outside the stabilization band; out-of-band dwell timer is running.
   OFF: Stabilization band function is disabled (S-HY = 0), uninitialized, or tripped on dwell timeout..
6. **SET Key:** Press for approximately 1 second to edit the setpoint (SP). Press and hold until LOCK appears to access the parameter menu; see Section 5 for the hold-time discrepancy in the source manual.
7. **Shift Key (◄):** In parameter setting mode, press to move the cursor to the next digit for modification.
8. **Down Key (▼):** Decreases the selected value.
9. **Up Key (▲):** Increases the selected value.

IV. Parameter Reference

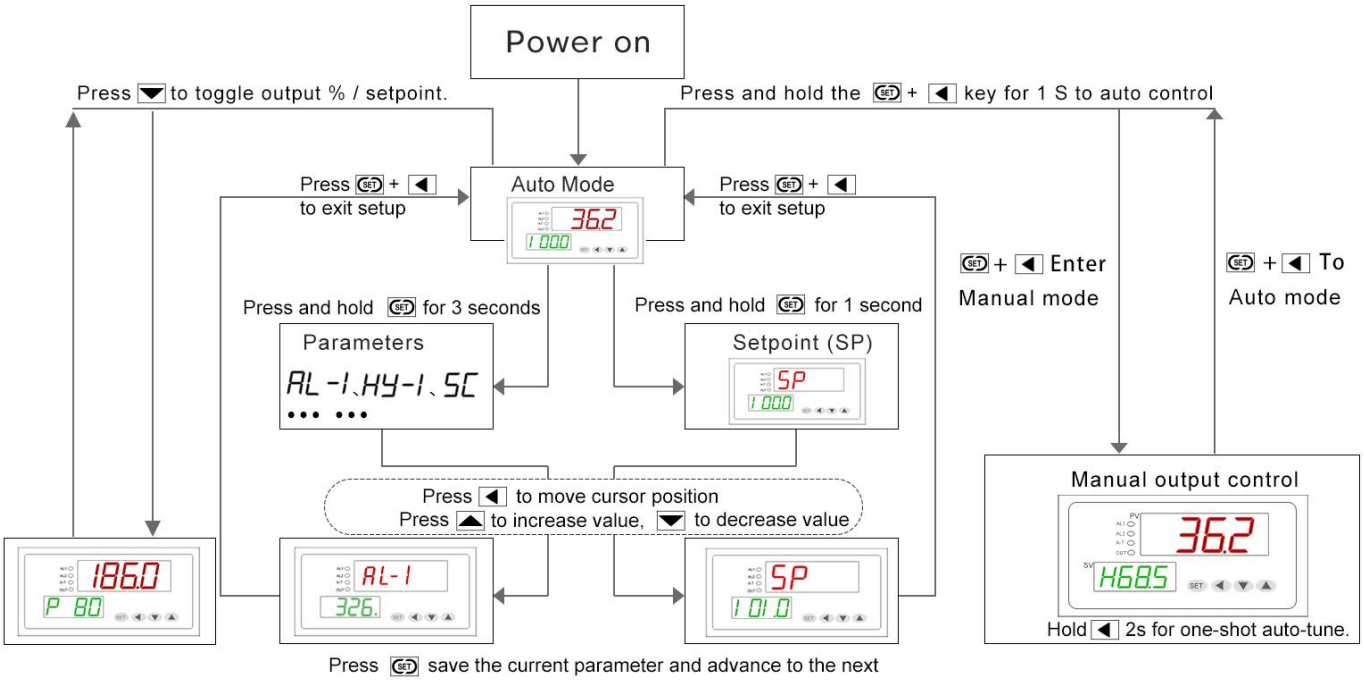
Table 4-1

No.	Symbol	Name	Range	Description	Default
0	SP	Setpoint Value	PS-L～PS-H	Target operating pressure. Press the SET key for 1 second to enter setpoint editing mode.	100.0
1	LoCK	Parameter Lock	0 - 250	Press and hold SET until LOCK appears. Enter the access code: • LOCK = 18: Parameters 1–27. • LOCK = 118: Parameters 1–5 and 28–33. • Other values: Parameters 1–5. See Section 5 for the hold-time discrepancy in the source manual.	18
2	AL-1	Alarm 1 Setpoint	PS-L～PS-H	Primary alarm trip threshold. Refer to Section 8: Alarm Configuration	300.0
3	AL-2	Alarm 1 Setpoint	PS-L～PS-H	Applies only when Alarm Mode (ALP) is configured for option 5 or 6 (In-Band / Out-of-Band Alarms). Sets the lower threshold.	100.0
4	ALHY	Alarm Hysteresis	0.1～100.0	Switching differential (deadband) to preven around the alarm trip point. Refer to Sectio Configuration.	0.5
5	ALP	Alarm Output Mode	0～8	Defines alarm operational logic (High, Low, Positive/Negative Deviation, In-Band, Out-of-Band). Refer to Section 8.	0
When Security Lock is set to LOCK = 18, Parameters 6 through 27 are accessible:					

6	Sn	Input Type	0～1	Selects the current input range: 0: 0–20 mA DC 1: 4–20 mA DC. For a model, confirm the applicable setting with t	0
7	SC	Offset	-100.0～100.0	Adjusts the displayed measurement to com transmitter error.	0.0
8	PS-H	Display Upper Limit	PS-L～9999	Upper display reading corresponding to full-scale analog input (20 mA or 10 V).	9999
9	PS-L	Display Lower Limit	-1999～PS-H	Lower display reading corresponding to the low end of the selected analog input range (0 or 4 mA for current input).	0
10	FILt	Display Digital Filter	0～100	Display damping coefficient to smooth display reading fluctuations caused by process pulsation.	20
11	dP	Decimal Point	0-3	Configures display resolution: 0 (XXXX), 1 (XXX.X), 2 (XX.XX), 3 (X.XXX).	1
12	oP	Output Define	0～3	rE — Reverse action: Output decreases as PV rises; commonly used for pressurizing. dr — Direct action: Output increases as PV rises; commonly used for depressurizing. LinE — Linear: Selects retransmission output; see Appendix 3.	0
13	t	Proportional Cycle Time	2-120S	Time-proportioning cycle base for electromechanical relay and SSR pulse outputs. Inactive for continuous analog current/voltage outputs.	10
14	P	Proportional Band	0～200.0	Proportional band width. Smaller values increase loop sensitivity (higher gain); larger values produce softer, more gradual control action.	15.0
15	I	Integral Time	0～ 9999S	Derivative time (rate). Provides damping in response to the rate of change of the process variable. Confirm the effect of a setting of 0 with the manufacturer.	240
16	d	Derivative Time	0～ 9999S	Derivative time (rate). Provides damping in response to the rate of change of the process variable. Confirm the effect of a setting of 0 with the manufacturer.	30
17	AtP	Tuning Pulse Amplitude	0-25.0	Auto-tune excitation pulse amplitude. In PID=FAST mode, sets step pulse height during tuning (use smaller values on fast, sensitive pressure loops). When PID = LAG: AT-P = 0 selects thermal tuning mode; AT-P = 1 selects pressure tuning mode.	10.0
18	tunE	Online Auto-Tune	ON/OFF	OFF: Adaptive tuning disabled. ON: Adaptive online tuning active. Refer to Section 6: Auto-Tuning Procedures.	OFF

19	S-HY	Stabilization Tolerance Band	PS-L～PS-H	Sets symmetrical deadband window around SP (e.g., SP=100, S-HY=5 establishes a 95–105 stable zone). Setting to 0 disables this function. Refer to Section 7: Stabilization Band Configuration.	0
20	dLY	Out-of-Band Dwell Timeout	0～999.9 S	Maximum permissible duration that PV may deviate outside the stabilization band before the controller trips and shuts down output (0%).	0
21	P-HY	In-Band Output Clamping	0-100.0	Restricts maximum control output regulation swing around steady-state baseline U0 when PV is inside the stabilization band.	0
22	P IdH	PID Output High Limit	0～100.0	Maximum allowable PID control output percentage clamp.	100.0
23	P IdL	PID Output Low Limit	0～100.0	Minimum allowable PID control output percentage clamp.	0.0
24	Pb-H	Retransmission High Scale	PS-L～9999	Active when OP = LINE. Defines the Process Value corresponding to 20 mA / 10 V (PB-H) and 4 mA / 0 V (PB-L) analog retransmission outputs.	9999
25	Pb-L	Retransmission Low Scale	-1999～PS-H		0
26	outH	Output Current High	outL～22.0	Sets upper and lower limits for the main control output. Applies only to current and voltage outputs.	20.0
27	outL	Output Current Low	0～outH		4.0
When Security Lock is set to LOCK = 118, Parameters 28 through 33 are accessible:					
28	P Id	PID Algorithm Mode	0-1	FASt : For fast-response pressure processes, including applications where the pressure output operates across the full range. LAG : Provides compensation for processes with lag, including temperature control or processes with nonlinear damping.	FASt
29	FLt	Input Noise Filter	0～20.00	Filters input signal noise. A setting that is too high can slow the process response; adjust with care.	0.50
30	Addr	Address	0～250	Modbus slave device station address on the serial network.	1
31	bAud	Baud Rate	0～3	4800； 9600；19200；34800	9600
32	PAr	Parity	0～2	**nonE** (none), **odd** (odd), and **EvEn** (even).	9999

V. Parameter Configuration



1. Level 1: Setpoint (SP) Adjustment

From the operating screen, press SET for approximately 1 second. The upper display (PV) shows SP.

Press ◄ to select a digit and ▼ or ▲ to adjust it. Press SET to save the setpoint and return to the operating screen.

2. Level 2: Parameter Configuration

From the operating screen, hold SET for 3 seconds until the upper display shows LOCK. Configure LOCK to define accessible parameters.

LOCK = 18: Parameters 1–27, in sequence. PV shows the parameter code; SV shows its current value.

LOCK = 118: Parameters 1–5 and engineering/communication parameters 28–33.

Any other LOCK value: Parameters 1–5 only.

Press ◄ to select a digit and ▼ or ▲ to adjust it. Press SET to save the value and advance to the next parameter.

3. Exiting Configuration

Press SET + ◄ simultaneously to return to the operating screen. Save each edited parameter with SET before exiting.

If no key is pressed for 10 seconds during configuration, the controller saves the parameters and returns to the operating screen.

4. Manual / Automatic Mode

Hold SET + ◄ simultaneously for 1 second to switch between Manual (MAN) and Automatic (AUTO) modes.

Manual: SV shows Hxx.x, the current output percentage. Use ▼ and ▲ to adjust the output. Press both keys simultaneously to save the setting so it is retained after a power interruption.

Automatic: SV shows the active setpoint (SP). The controller uses closed-loop PID control to maintain process pressure.

⚠ POWER-UP MODE

The controller powers up in Manual Mode (MAN) by default in these cases:

- New instrument initial power-on / factory commissioning
- PID algorithm mode changed (FAST ↔ LAG)
- Factory reset (hold ▼ during power-up until lower display shows RST)

Once a manual auto-tune is saved successfully, the power-on default switches to Auto Mode. Keep this behavior in mind during commissioning and restarts.

VI. Auto-tuning (AT)

1. Manual Auto-Tuning

1.1 Procedure

1. Connect the pressure transmitter and controlled equipment. Set SP to the target pressure.
2. Confirm that the controller is in manual mode. The lower display shows Hxx.x (current output percentage). If it is in automatic mode, hold SET + ◀ for 1 second to switch to manual mode.
3. Set the output according to the PID mode:
   - FAST: Use ▼ and ▲ to adjust the output until PV is near SP.
   - LAG: Set the output to 0.0% and wait for pressure to return to its initial startup condition.
4. Hold ◀ for 2 seconds to start auto-tuning. The lower display shows AtunE, then DonE when tuning is complete.
5. Press SET + ◀ to save the PID parameters and exit manual mode. The controller then regulates the output automatically.

1.2 Tuning Principle

- FAST: The controller adds a tuning pulse to the current manual output, measures the process response, and calculates PID parameters.
- LAG: The controller drives the output to 100%. When pressure reaches the midpoint between PV and SP, it turns the output off and calculates PID parameters from the pressure overshoot.

2. Online Auto-Tuning

2.1 Operation

In automatic mode, hold SET until LOCK appears. Set LOCK to 18, then set tunE to ON. The lower display alternates between tunE and SP. See Section 5 for the hold-time discrepancy.

2.2 Saving Results

Online-tuned PID parameters are not automatically saved when power is removed. To save them, hold ◀ for 2 seconds in automatic mode:

- SAVE: New PID parameters were calculated and saved.
- CLOS: No new PID parameters were calculated.

Either action ends online auto-tuning and returns to the normal display.

2.3 Notes

- A manual auto-tune is recommended first to establish initial PID parameters.
- Online auto-tuning is not recommended when the process remains stable for extended periods, as it may degrade control performance.
- Frequent manual adjustments or pressure disturbances during tuning can cause incorrect PID calculations.

2.4 Tuning Principle

The controller monitors PV for oscillations caused by load disturbances or setpoint changes. When it detects a usable oscillation, it updates the PID parameters.

⚠ **FUNCTION RESTRICTION**

Do not enable stabilization band mode (**S-HY > 0**) while online auto-tuning (**tunE = ON**) is running.

VII. Stabilization band configuration (advanced function, disabled by default)

The stabilization band defines a tolerance range around the setpoint. If PV remains outside the band for the configured delay, the controller turns off the control output and requires operator intervention and reset. Being

within the band does not by itself guarantee product quality or process safety.

Stability Criteria:

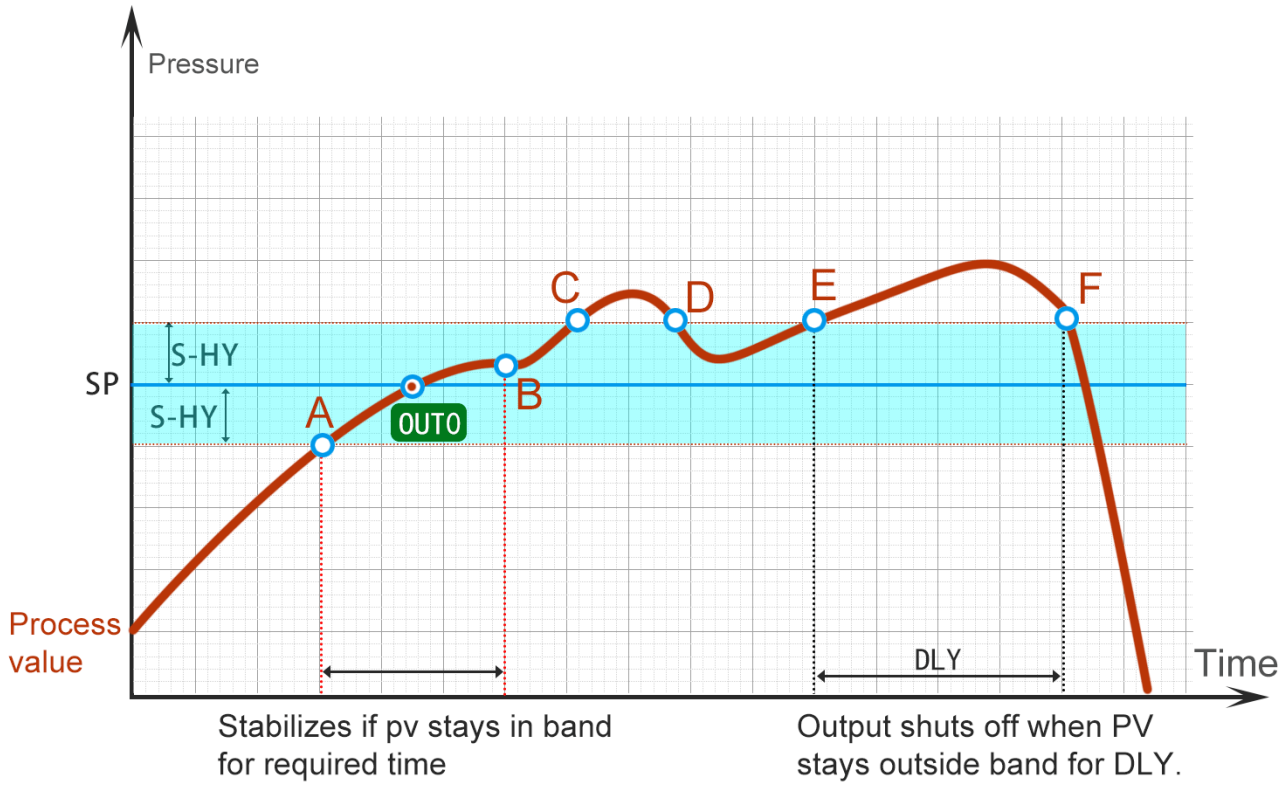
The process variable (PV) must remain within the stabilization band for at least 60 consecutive seconds before stability is established. Briefly entering the band does not establish stability.

S-HY(S-HY): The stabilization band extends from SP − S-HY to SP + S-HY. Set S-HY to 0 to disable the function; P-HY and DLY are then inactive.

DLY(dLY): Out-of-band timeout (0–999.9 s). If PV remains outside the band for at least DLY, the controller sets the output to 0% (STOP). Press SET + ◀ to clear the fault and restart the stabilization timer.

P-HY(P-HY): In-band output limit (0–100.0%). Limits output variation around OUT0 (U0) while PV is within the band. At 100%, P-HY imposes no limit; at 0%, the output remains at OUT0 regardless of deviation.

U0 (OUT0): Nominal output percentage when PV is near the setpoint within the stabilization band (see illustration below).



Phase	Operating Status	A-T LED	SV Display	Output Clamping Limit
A-B	Acquiring Stabilization Dwell Timer Running	OFF	SP	P IdL ≤ OUT ≤P IdH
B-C	Locked In-Band Steady State	ON	SP	U0 − P-HY ≤ OUT ≤ U0 + P-HY
C-D	Out-of-Band Transient Elapsed < DLY	Flashing	LEFT / SP	OUT = OUT0
D-E	Band Re-entry & Recovery	ON	SP	U0 − P-HY ≤ OUT ≤ U0 + P-HY
E-F	Out-of-Band Excursion	Flashing	LEFT / SP	OUT = OUT0
F	Timeout Tripped Elapsed ≥ DLY	OFF	STOP	OUT = 0%

VIII. Alarm Modes (Optional Feature)

Alarm Mode (ALP)	Alarm ON Condition	Alarm OFF Condition
1 High Limit	PV ≥ AL-1	PV < AL-1 − ALHY
2 Low Limit	PV ≤ AL-1	PV > AL-1 + ALHY
3 Positive Deviation	PV ≥ SP + AL-1	PV < SP + AL-1 − ALHY
4 Negative Deviation	PV ≤ SP − AL-1	PV > SP − AL-1 + ALHY
5 Outside Band	PV ≤ AL-2 or PV≥ AL-1	AL-2 + ALHY< PV < AL-1 − ALHY
6 Inside Band	AL-2 ≤ PV ≤ AL-1	PV < AL-2 − ALHY or PV > AL-1 + ALHY

PV = Measured Value, SP = Setpoint, AL1/AL2 = Alarm Setpoints, ALHY = Alarm Hysteresis.

IX. Troubleshooting

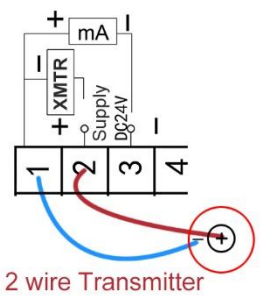
Fault	Possible Cause	Corrective Action
1. Display reading does not match actual line pressure.	Transducer signal type or range scaling mismatch (e.g. 0–20 mA vs 4–20 mA, or incorrect P-SL / P-SH settings).	Check the transmitter specifications and input type. Confirm that P-SL and P-SH match the transmitter's lower and upper pressure range.
2. Display shows '-HH-' or '-LL-'.	Signal wiring reversed, open circuit, short circuit, or loose terminal.	Check wiring continuity and polarity per Appendix 2, then re-terminate securely.

Appendix 1: 7-Segment Display Character Set

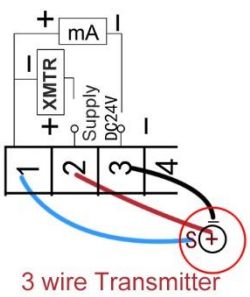
This chart shows the 7-segment display representation for alphabetical characters used in parameter symbols.

A	B	C	D	E	F	G	H	I	J	K	L	M
A	b	C	d	E	F	G	H	I	J	K	L	M
N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**Y**		
n	o	P	q	r	S	t	u	v	w	y		

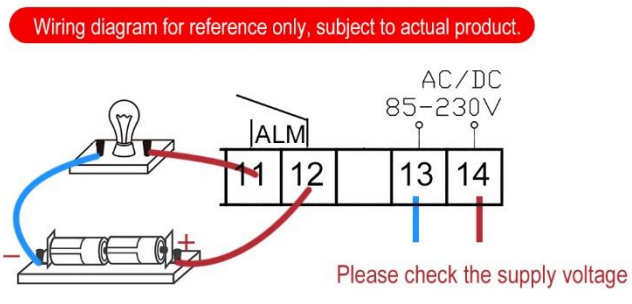
Appendix 2: Terminal wiring & signal connections



2 wire Transmitter



3 wire Transmitter



Please check the supply voltage

Appendix 3: Analog retransmission configuration & process input scaling

1. Direct Retransmission Scaling (4–20 mA Output Proportional to Rising PV):

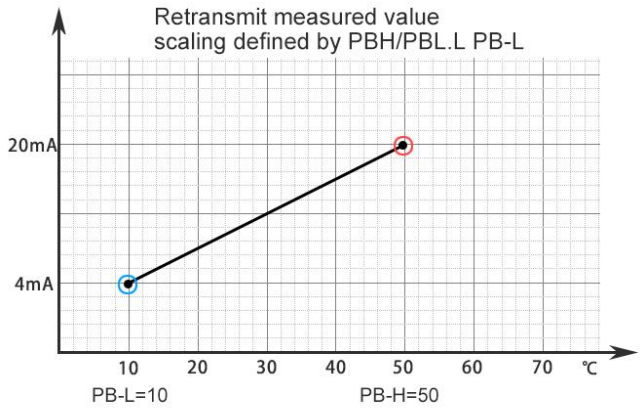
Example: PV = 0.0 corresponds to 4.0 mA retransmission output; PV = 100.0 corresponds to 20.0 mA retransmission output:

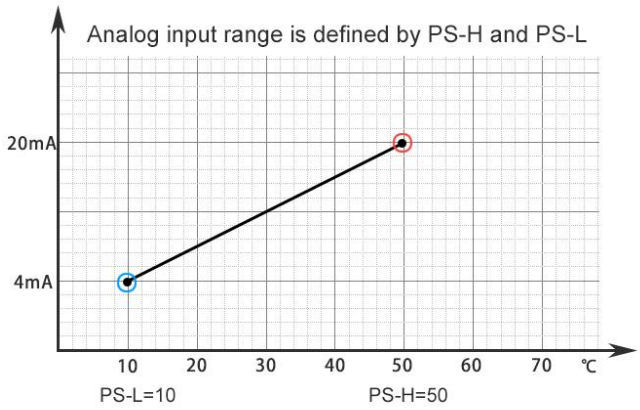
Parameter Code	**OP**	**PB-H**	**PB-L**
Configured Value	**LINE**	**100.0**	**0.0**
Parameter cross-reference: Table 4-1 — OP (Index 12), PB-H (Index 24), PB-L (Index 25).			

2. Reverse Retransmission Scaling (20–4 mA Output Inversely Proportional to Rising PV):

Example: PV = 0.0 corresponds to 20.0 mA retransmission output; PV = 100.0 corresponds to 4.0 mA retransmission output:

Parameter Code	**OP**	**PB-H**	**PB-L**
Configured Value	**LINE**	**4.0**	**100.0**





Appendix 4: Modbus-RTU Communication (Optional)

Purpose

This appendix describes RS485/RS232 communication setup, Modbus-RTU message format, read/write examples, and common troubleshooting steps.

1. Interface Specifications

For centralized monitoring and control through a PC, PLC, or HMI, the controller provides RS485 or RS232 communication (hardware option dependent). The communication interface is designed for robust industrial environments and supports up to 255 controllers on one network.

2. Communication Protocol

(1) Communication parameters:

- **Baud Rate:** 4800 / 9600 / 19200 / 38400
- **Frame:** 1 start bit, 8 data bits, 1 stop bit, no parity (8-N-1)

(2) Supported function codes:

03 (Read Holding Registers), 06 (Write Single Register), 10 (Write Multiple Registers). Data is transmitted as signed 16-bit integers.

3. Command Read/Write Examples

3.1 Read Holding Register (Function 03)

Example: read measured value from register address 0x1001.

Controller Address	Function Code (03)	Register Address	Register Count	CRC16
Host to controller request: **01 03 10 01 00 01 D1 0A**				
Message breakdown	01 (address) 03 (function) 1001 (measured value) 0001 (quantity) D10A (CRC)			

3.2 Controller Response Format (Hex)

Controller Address	Function Code	Returned Byte Count (2 bytes)	Parameter Value	CRC16
Controller to host response: **01 03 02 00 78 B8 66**				
Message breakdown	01 (address) 03 (function) 02 (2 bytes returned) 0078 (value) B866 (CRC)			
Note 1: Hex value **0x0078** equals decimal **120**. For temperature signals, divide by 10, so actual temperature is **12.0 C**. Note 2: If returned value is **0x7FFF**, display shows **-HH-**. If returned value is **0x7F00**, display shows **-LL-**.				

3.3 Write Single Register (Function 06)

Example: write decimal **1260** to register **0x0000** (SP).

Controller Address	Function Code (06)	Register Address	Parameter Value	CRC16
Host to controller write request: **01 06 00 00 04 EC 8A 87**				
Message breakdown	01 (address) 06 (function) 0000 (register) 04EC (value)8A87 (CRC)			
Note: Hex value **0x04EC** equals decimal **1260**. Actual accepted value depends on that register's limit range and decimal scaling. For example, if writing to temperature setpoint SP with one decimal place, 1260 means **126.0**. If writing to an alarm mode register with a smaller allowed range, out-of-range writes are ignored.				

4. Common Communication Questions

Q1: Controller does not respond to host read/write commands. What should be checked?

- Keep only one host and one controller on the bus to isolate wiring/noise issues.
- Set communication timeout to at least 200 ms and communication delay to at least 250 ms.
- Verify controller address (ADDR) and confirm message format complies with Modbus-RTU specification.

Q2: How can PLC/HMI/SCADA communicate with this controller?

- Use the Modbus examples in this appendix and match baud rate, station address, and register map.

Modbus Integration

URL http://www.kcmeter.com/servicesread.asp?id=4

QR Code

5. Register Address List

Name	Decimal Point	Absolute Address	Holding Register (Siemens PLC mapping)
Measured Value (PV)	YES	1001H	44098
Main Output (0~100%)	NO	1101H	44354
Alarm Output (0/1)	NO	1201H	44610

Force Output OFF	NO	0101H	40258 (write 1 to force OFF)
Force Alarm OFF	NO	0201H	40514 (write 1 to force OFF)
Parameter Register Address (refer to Table 4-1)			
SP	YES	0000H	40001
LOCK	NO	0001H	40002
.....			
PAR	NO	0016H	40034

Appendix 6: Measurement Data Logging (Paperless Recording, Optional)

The companion logger stores data on a TF card (micro SD). It supports real-time recording of multiple process signals such as temperature, humidity, level, and pressure, with a minimum logging interval of 1 second.

The logger is commonly used for environmental data monitoring and traceability in food, pharmaceutical, and chemical storage applications, including warehouses, cold rooms, medicine storage rooms, cool storage rooms, and laboratories.

Data files are generated in CSV format and can be opened directly in Excel. Dedicated software can also generate professional reports and trend curves (available from the official website).

Technical Specifications

Storage Method: TF card (micro SD)

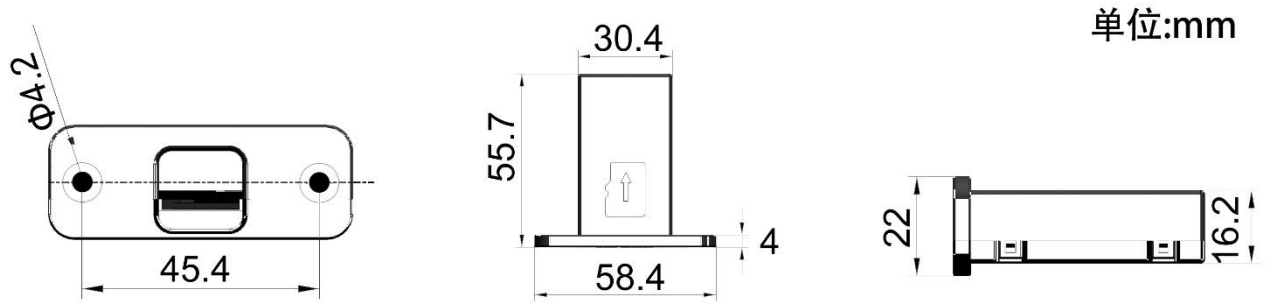
Logging Interval: minimum 1 second per sample, maximum 1 hour per sample

Storage Capacity: 1 GB TF card stores approximately 15.768 million records; common card sizes are 16 GB to 128 GB

Operating Environment: ambient temperature 0 to 60.0 C, relative humidity <=85%, non-corrosive atmosphere, no strong EMI

Power Supply: powered directly by controller, DC 5 V

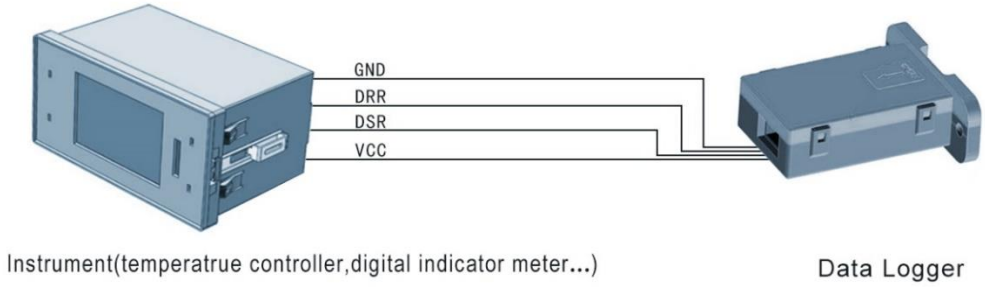
Logger Dimensions:



Logger Operation

1. **Wiring**

The logger uses a 4-wire connection: 5V, DSR, DRR, GND. Connect each wire to the controller terminals labeled 5V, DSR, DRR, and GND respectively.



2. Power-Up

After controller power-up, the logger enters operation automatically.

3. Start Logging

When powered and a TF card is inserted, the logger enters data-recording mode automatically.

4. Set Logging Interval

In Table 5-1 (Parameter Codes and Symbols), find parameter Interval (addr) and set recording interval:

- Set value to 1 for 1-second interval.
- Maximum value is 3600, corresponding to 1-hour interval.

5. Set System Time

When logger and controller are operating normally, press and hold ▼ and ▲ simultaneously to enter time-setting mode.

The display cycles through year, month, day, hour, and minute tags (see Table 6-1). For value editing, follow the standard controller key operation method.

Table 6-1

No.	Code	English	Name	Description	Range
1	YEAr	YEAR	Year	Sets year parameter	2000～2099
2	nth	MTH	Month	Sets month parameter	00～12
3	dAY	DAY	Day	Sets day parameter	00～31
4	Hour	HOUR	Hour	Sets hour parameter	00～23
5	nIn	MIN	Minute	Sets minute parameter	00～59

Logger Status LED Indications

1. Normal operation: green LED is steady ON; red LED flashes once quickly during data write.
2. Logger-controller link failure: green LED blinks (ON/OFF).
3. Communication interference: red and green LEDs flash simultaneously or alternately.
4. No TF card or TF card fault: red LED blinks (ON/OFF).

Appendix 7: Model Selection Guide

Model	KC	□	□	□	□	□	□	□
Dimensions	96×96 mm Panel Cutout: 92×92 mm	MA						
	96×48 mm Panel Cutout: 92×44 mm (Horizontal)	MF						
	48×96 mm Panel Cutout: 44×92 mm (Vertical)	ME						
	72×72 mm Panel Cutout: 68×68 mm	MD						
Mounting Option	Panel Mounting		7pr					
Alarm	1 alarm relay			1				
Input Type	linear voltage/current. **One specification per fixed input type**				A			
Output	Relay Output					□		
	SSR Drive (0-12 V)					G		
	Analog Output: 4-20 mA or 0-10 V					A		
Power Supply	100 ~ 240V AC						□	
	24V DC						1	
Options	RS-485 (Modbus-RTU)							RS
	RS-232 (Modbus-RTU)							RX
	Paperless logging							LG
	WI-FI (Modbus-TCP)							WIFI