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Operating Manual

High Precision Load Cell Transmitter

RW-ST02D

SMOWO®

Content

Product Introduction

- built-in 24 bit high precision AD converter
- multistage linear calibration function
- configurable software filtering algorithm
- automatic zero point track
- standard Modbus RTU communication protocol
- quick and easy module address setting

Technical Data

power supply: (12-32)Vdc
power consumption: <0.75W@24V (350Ω load cell 2pcs)

output interface: two-wire RS485
baud rate: 4800-115200bps
data format: 8 bit data, 1 stop bit
check mode: None/Odd/Even
communication protocol: Modbus RTU

load cell sensitivity supported: (0-4.0)mV/V, customized for special sensitivity
load cell Exc. voltage: 5V
loading capacity: 350Ω load cell 2 pcs at most

conversion rate: (5, 10, 20, 40, 80, 320, 640, 1280) times/second

case material: aluminum alloy
gross weight: around 177g

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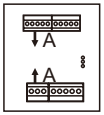
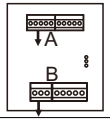
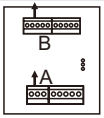
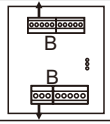
Order Information

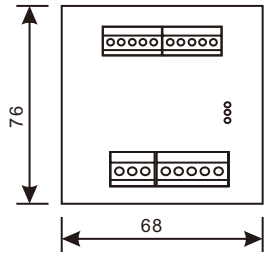
RW-ST02D- [ ] - [ ]
install mode, wiring mode

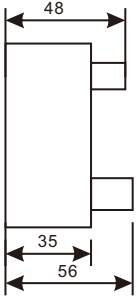
Optional List

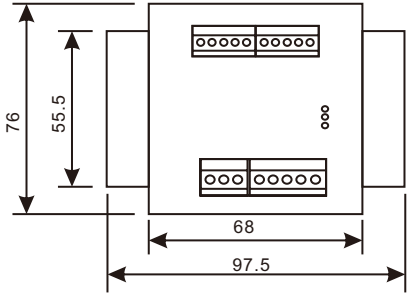
No	install mode	wiring mode		
1	G:din rail None: enclosure fixed	AA	A- load cell wiring inside A-power communication terminal wiring inside	
2		AB	A-load cell wiring inside B-power& communication terminal wiring outside	
3		BA	B-load cell wiring outside A-power & communication terminal wiring inside	
4		BB	B-load cell wiring outside B-power & communication terminal wiring outside	

Dimension(mm)

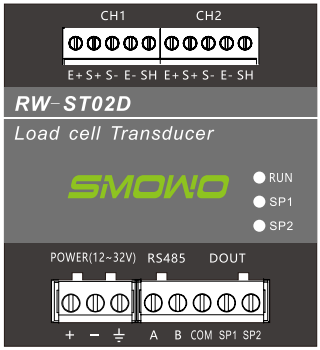
Din Rail







Terminal Instruction



E+	load cell Exc voltage +
S+	load cell Sig output +
S-	load cell Sig output -
E-	load cell Exc voltage -
SH	load cell cable shielded layer
+	DC(12-32)V power supply +
-	DC(12-32)V power supply -
⏚	GND
A	RS485 comm. + terminal
B	RS485 comm. - terminal
Com	common
SP1	1st channel alarm
SP2	2nd channel alarm

Wiring Description:

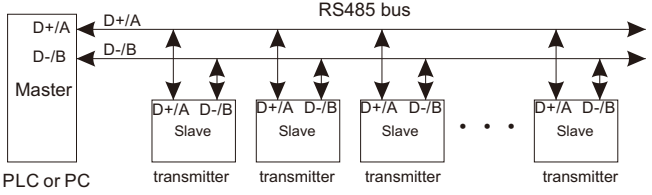
① Please disconnect power supply of transmitter, before wiring

② Transmitter terminal is pluggable. Please connect wiring and terminal plug well, then plug into socket of transmitter, and pay attention to correct position. Recommend to use needle cold-pressure terminal to keep reliable connection.

③ Please use special shielding wire for load cell connecting, and not bound with AC power cable. Connect load cell shielding cable to SH connection port and connect to earth.

Communication Interface

Transmitter communication interface is RS485 serial communication standard. RS485 is half-duplex communication, supporting master-slave mode of multiprocessor communication network. Master can be PLC, HMI and controller or PC with RS485 interface. Please follow below diagram to connect all the RS485 interface communication of master-slave device for networking:



Please check related documents for other attentions of RS485 standards

Modbus RTU communication protocol

①read current measured value of communication address 1, and use function code 03 to read holding register
Register No. of measured value is 0000-0001, length is 4 byte signed long integer, high 16 bytes in front. Dimension is related with calibration. For example, if load cell range is 800kg, and calibration is 800000, which means the data read is actual measured value, and unit is g. If calibration is 80000, the value unit read is 0.01kg. This transmitter does not support decimal point.
Host send:
01 03 00 00 00 02 C4 0B (slave address: 01, function code 03, read 2 consecutive holding register from 0000, the last is CRC calibration code)
Transmitter send:
01 03 04 00 01 05 E2 28 EA (slave address: 01, function: 03, responsive 4 byte data: 00 01 05 E2, which means decimal 67042, that is, measured value is 67042, the last is CRC calibration code)

FC01 read coil. read clear state, coil No. supported below:

coil	coil address (Hex)	Description
PC1	000B	read channel 1 clear state
PC2	000C	read channel 2 clear state
SC1	0011	read channel 1 stable state
SC2	0012	read channel 2 stable state

read 000B coil:
host send: 01 01 00 0B 00 01 8C 08
transmitter address: 01, function code: 01, coil address: coil address 00 0B, coil qty: 00 01, CRC16 checking code: 8C08
transmitter send(cleared): 01 01 01 FF 11 C8
transmitter send(unclear): 01 01 01 00 51 88
FF stable, 00 not stable

FC05 write coil. read clear state, coil No. supported below:

coil	coil address (Hex)	Description
TC	000A	clear sum
PC1	000B	channel 1 clear
PC2	000C	channel 2 clear
cal	0010	calibration enabled
Tbu	0011	back up (ff), (00 restore to backup)
Tfc	0012	restore to factory setting

write 000A coil FF 00 to make clear for SUM:
host send: 01 05 00 0A FF 00 AC 38
transmitter send: 01 05 00 0A FF 00 AC 38
clear value can be saved if power down

write 000A coil 00 00 to make anti-clear for SUM
transmitter send: 01 05 00 0A 00 00 ED C8
transmitter send: 01 05 00 0A 00 00 ED C8

Parameter and Modbus Holding Register Address

Parameter	Register Address (Hex)	Access	Range	Description
SUM	0000-0001	R/W	32bit integer	the sum of all the channels
PV1	0002-0003	R/W	32 bit integer	channel 1 measured value
PV2	0004-0005	R/W	32 bit integer	channel 2 measured value
CH1SENSE	0006-0007	R/W	32 bit integer	channel 1 sensitivity
CH1INP1	0008-0009	R/W	32 bit integer	channel 1: 0mV internal code
CH1INP2	000A-000B	R/W	32 bit integer	channel 1: 2mV internal code
CH1IOFFSET	000C-000D	R/W	32 bit integer	display offset of channel 1
CH1POINT	000E-000F	R/W	32 bit integer	calibration points of channel 1
CH1AVP1	0010-0011	R/W	32 bit integer	1st calibration point internal code of channel 1
CH1AVP2	0012-0013	R/W	32 bit integer	2nd calibration point internal code of channel 1
CH1AVP3	0014-0015	R/W	32 bit integer	3rd calibration point internal code of channel 1
CH1AVP4	0016-0017	R/W	32 bit integer	4th calibration point internal code of channel 1
CH1AVP5	0018-0019	R/W	32 bit integer	5th calibration point internal code of channel 1
CH1AVP6	001A-001B	R/W	32 bit integer	6th calibration point internal code of channel 1
CH1AVP7	001C-001D	R/W	32 bit integer	7th calibration point internal code of channel 1
CH1AVP8	001E-001F	R/W	32 bit integer	8th calibration point internal code of channel 1
CH1AVP9	0020-0021	R/W	32 bit integer	9th calibration point internal code of channel 1
CH1PVP1	0022-0023	R/W	32 bit integer	1st calibration point display value of channel 1
CH1PVP2	0024-0025	R/W	32 bit integer	2nd calibration point display value of channel 1
CH1PVP3	0026-0027	R/W	32 bit integer	3rd calibration point display value of channel 1
CH1PVP4	0028-0029	R/W	32 bit integer	4th calibration point display value of channel 1
CH1PVP5	002A-002B	R/W	32 bit integer	5th calibration point display value of channel 1
CH1PVP6	002C-002D	R/W	32 bit integer	6th calibration point display value of channel 1
CH1PVP7	002E-002F	R/W	32 bit integer	7th calibration point display value of channel 1
CH1PVP8	0030-0031	R/W	32 bit integer	8th calibration point display value of channel 1
CH1PVP9	0032-0033	R/W	32 bit integer	9th calibration point display value of channel 1
CH1ADSSPEED	0034-0035	R/W	32 bit integer	channel 1 ADC sample rate
CH1FILTER	0036-0037	R/W	32 bit integer	channel 1 filter strength

Parameter	Register Address (Hex)	Access	Range	Description
CH1BAND	0038-0039	R/W	32 bit integer	channel 1 filter band
CH1ATZT	003A-003B	R/W	32 bit integer	channel 1 zero point track time
CH1ATZB	003C-003D	R/W	32 bit integer	channel 1 zero point track band
CH1STBT	003E-003F	R/W	32 bit integer	channel 1 stability time
CH1STBB	0040-0041	R/W	32 bit integer	channel 1 stability condition
CH2SENSE	0044-0045	R/W	32 bit integer	channel 2 sensitivity
CH2INP1	0046-0047	R/W	32 bit integer	channel 2: 0mV internal code
CH2INP2	0048-0049	R/W	32 bit integer	channel 2: 2mV internal code
CH2OFFSET	004A-004B	R/W	32 bit integer	channel 2 display offset
CH2POINT	004C-004D	R/W	32 bit integer	channel 2 calibration point
CH2AVP1	004E-004F	R/W	32 bit integer	1st calibration point internal code of channel 2
CH2AVP2	0050-0051	R/W	32 bit integer	2nd calibration point internal code of channel 2
CH2AVP3	0052-0053	R/W	32 bit integer	3rd calibration point internal code of channel 2
CH2AVP4	0054-0055	R/W	32 bit integer	4th calibration point internal code of channel 2
CH2AVP5	0056-0057	R/W	32 bit integer	5th calibration point internal code of channel 2
CH2AVP6	0058-0059	R/W	32 bit integer	6th calibration point internal code of channel 2
CH2AVP7	005A-005B	R/W	32 bit integer	7th calibration point internal code of channel 2
CH2AVP8	005C-005D	R/W	32 bit integer	8th calibration point display value of channel 2
CH2AVP9	005E-005F	R/W	32 bit integer	9th calibration point display value of channel 2
CH2PVP1	0060-0061	R/W	32 bit integer	1st calibration point display value of channel 2
CH2PVP2	0062-0063	R/W	32 bit integer	2nd calibration point display value of channel 2
CH2PVP3	0064-0065	R/W	32 bit integer	3rd calibration point display value of channel 2
CH2PVP4	0066-0067	R/W	32 bit integer	4th calibration point display value of channel 2
CH2PVP5	0068-0069	R/W	32 bit integer	5th calibration point display value of channel 2
CH2PVP6	006A-006B	R/W	32 bit integer	6th calibration point display value of channel 2
CH2PVP7	006C-006D	R/W	32 bit integer	7th calibration point display value of channel 2
CH2PVP8	006E-006F	R/W	32 bit integer	8th calibration point display value of channel 2
CH2PVP9	0070-0071	R/W	32 bit integer	9th calibration point display value of channel 2
CH1ADSSPEED	0072-0073	R/W	32 bit integer	channel 2 ADC sample rate

Parameter	Register Address (Hex)	Access	Range	Description
CH2FILTER	0074-0075	R/W	32 bit integer	channel 2 filter strength
CH2BAND	0076-0077	R/W	32 bit integer	channel 2 filter band
CH2ATZT	0078-0079	R/W	32 bit integer	channel 2 zero point track time
CH2ATZB	007A-007B	R/W	32 bit integer	channel 2 zero point track band
CH2STBT	007C-007D	R/W	32 bit integer	channel 2 stability time
CH2STBB	007E-007F	R/W	32 bit integer	channel 2 stability condition
DN	0082-0083	R/W	32 bit integer	transmitter address
BAUD	0084-0085	R/W	32 bit integer	communication baud rate: 0-4800; 1-9600;2-19200;3-38400;4-57600;5-115200
PRTY	0086-0087	R/W	32 bit integer	parity 0-none 1-odd 2-even
FIRH	0088-0089	R/W	32 bit integer	high and low register
SP1M	008A-008B	R/W	32 bit integer	alarm 1 mode: 0 no, 1 low, 2 high, 3 out of range, 4 in the range
SP1A	008C-008D	R/W	32 bit integer	alarm 1 track channel: 0-CH1, 1-CH2, 2-SUM, 3-Any2, 4-All2
SP1V	008E-008F	R/W	32 bit integer	alarm 1 alarm value
SP1B	0090-0091	R/W	32 bit integer	alarm 1 range value
SP2M	0092-0093	R/W	32 bit integer	alarm 2 mode: 0 no, 1 low, 2 high, 3 out of range, 4 in the range
SP2A	0094-0095	R/W	32 bit integer	alarm 1 track channel: 0-CH1, 1-CH2, 2-SUM, 3-Any2, 4-All2
SP2V	0096-0097	R/W	32 bit integer	alarm 2 alarm value
SP2B	0098-0099	R/W	32 bit integer	alarm 2 range value

Remarks:

- in communication, data is transferred by the way of integer, so there is no decimal point.
- If needing decimal point, please set on the software.
- For example: For one load cell with range 10kg, if resolution of measured value reach to 1g, it needs to calibrate transmitter PVP2 to 10000 display code. (supposing apply two points calibration here); if needing resolution 0.1g, it needs to calibrate PVP2 to display code 100000. After host read measured value, user needs to handle decimal point to show actual weight correctly, according to resolution. The former have no decimal point, so it show g directly; the later needs to add one decimal point, divide measured value by 10 and then show g. If write this parameter 0, please make measured value “clear”. If write a nonzero value, user needs to modify current value to this value, that is, preset measured value.
- Parameter FILTER value is higher, measured value is more stable, but measured delay is bigger. If the difference absolute value of two successive measured results is higher than parameter FBND, filter direct connection can quicken response speed. If amplitude of measured value is bigger, please increase FBND appropriately.
- If absolute value of measure value less than ATZB and keep stable within the time set by ATZT, measured value return to zero automatically. In the application of filling and feeding, please note that weight rate of increase and decrease higher than ATZB/ATZT, or the added weight will be cleared automatically.

Communication Example

1. Read measured value, read holding register by function code 03
Register No. of measured value is 0000-0001, length is 4 byte signed long integer, and dimension is related with calibration. For example, if load cell range is 800kg, and calibration to 800000, which means the data got is actual measured value, and unit is g. If calibrate to 80000, the value unit read is 0.01kg. This transmitter does not support decimal point.

Query message from Host:
01 03 00 00 00 02 C4 0B (slave address: 01, function 03, read 2 consecutive holding register from 0000, the last is CRC calibration code)
Responsive message from transmitter:
01 03 04 00 01 05 E2 28 EA (slave address: 01, function: 03, responsive 4 byte data: 00 01 05 E2, which means decimal 67042, that is, measured value is 67042, the last is CRC calibration code)
2. Setting transmitter device address (slave address): use function code 10 to write many holding register. For example: the original device address is 01, need to revise to 10.

Query message from Host:
01 10 00 02 00 02 04 00 00 00 0A F2 71 (slave address is 01, function:10, write 2 consecutive holing register from 0002, total data bytes:4, new address 10 is changed to 32-byte hex 00 00 00 0A, the last is CRC calibration code)
Responsive message from transmitter:
01 10 00 02 00 02 E0 08 (slave address: 01, function: 10, write 2 consecutive holding register from 0002, the last is CRC calibration code)
3. Clear: write measured value register 0 directly.
If need to show other value, please write the corresponding value to make display presetting. However, please note that this operation could not save zero value in the inner part of transmitter, when power up next time, it will return to original set value.

Query Message from Host:
01 10 00 00 00 02 04 00 00 00 00 F3 AF (slave address:01, function: 10, write 2 consecutive holding register from 0000, total data bytes: 4, set displayed value 0, the last is CRC calibration code)
Responsive Message from transmitter:
01 10 00 00 00 02 41 C8 (slave address: 01, function 10, write 2 consecutive holding register from 0000, the last is CRC calibration code).

4. Zero setting:
method one :
First read present displayed value, and then write it into transmitter zero point register. Please note that do not make clear before this operation. Writing zero tracing value 0 is used for factory testing. So we suggest using clear function, so as not to shorten service life of inner part of transmitter.

method two:
Query Message from Host:
01 05 00 0A FF 00 AC 38 (slave address: 01, function code: 05, coil address: 000A (clear sum) , write coil address: FF00, checksum: AC38)
transmitter send same command:
01 05 00 0A FF 00 AC 38

5. MODBUS Command Calibration
Take CH1 channel 1 calibration mode for example:
5.1 write channel calibration point CH1POINT register of CH1:
host send: 01 10 00 14 02 04 00 00 00 02 72 91
transmitter send: 01 10 00 14 00 02 CC 01

5.2 write 0010 coil FF00 to open calibration enable
host send: 01 05 00 10 FF 00 8D FF
transmitter send: 01 05 00 10 FF 00 8D FF

5.3 write first calibration point display value (0) for channel CH1
host send: 01 10 00 28 00 02 04 00 00 00 00 f0 11
transmitter send: 01 10 00 14 00 02 C0 C1

5.4 write 0010 coil FF00 to open calibration enable
host send: 01 05 00 10 FF 00 8D FF
transmitter send: 01 05 00 10 FF 00 8D FF

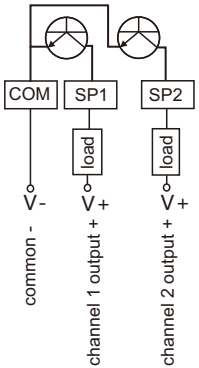
5.5 write second calibration point display value (10000) for channel CH1

Query Message from Host:
01 10 00 2A 00 02 04 00 00 27 10 6B F4
transmitter send:
01 10 00 14 00 02 00 60 calibration finish

5.6 write 000A coil FF00 to make clear for SUM:
Query Message from Host:
01 05 00 0A FF 00 AC 38
transmitter send:
01 05 00 0A FF 00 AC 38 this cleared value can be saved after power down

5.7 write 000A coil 0000 to make anti-clear for SUM
Query Message from Host:
01 05 00 0A 00 00 ED C8
transmitter send:
01 05 00 0A 00 00 ED C8

two channel transistor (NPN) output alarm mode:



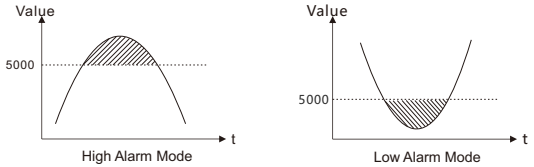
SP1M/SP2M: channel 1/channel 2 alarm mode. there are 5 modes:
Band_I alarm mode in range
Band_O alarm mode out of range
High high alarm mode
Low low alarm mode
Disable no alarm output mode

SP1A/SP2A: alarm1/2 tracking channel
0:CH1 — CH1 value meets alarm condition, SP1/SP2 alarm
1:CH2 — CH2 value meets alarm condition, SP1/SP2 alarm
5:SUM — SUM value meets alarm condition, SP1/SP2 alarm
6:Any2 — one of CH1 or CH2 meets alarm condition, SP1/SP2 alarm

Application Example: track channel CH1 High alarm and Low alarm mode
High alarm mode: CH1 first channel set point display value higher than 5000, output alarm
first channel SP1M set point 2 (high alarm), alarm value SP1V 5000, so if display value ≥5000 alarm and < 5000 not alarm.

Low alarm mode: CH1 second channel set point less than 5000,output alarm
second channel SP2M set point 1 (low alarm), alarm value SP2V 5000, so ≤5000 alarm and > 5000 not alarm.

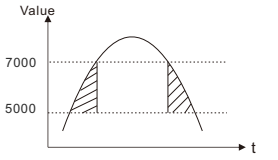
High Alarm Mode Process



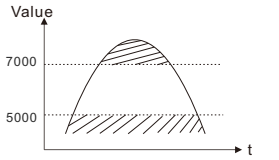
Application Example: track channel CH1 Band_I in range and Band_O out of range alarm mode
CH1 first channel set point display value 5000-7000, outp alarm first channel SP1M set point 4 (alarm in range), alarm value SP1V 5000, interval value SP1B 2000, so alarm if 5000≤CH1 display value ≤7000 (5000+2000), not alarm if display value > 7000 and < 5000.

CH2 second channel set point display value in 5000-7000,output alarm second channel SP2M set point 3 (alarm out of range), alarm value SP2V 5000, so alarm if CH1 second channel display value ≥7000 (5000+2000) and ≤5000, not alarm if display value < 7000 and > 5000

Band_I Alarm Process



Band_I Alarm in Range Mode



Band_O Alarm out of Range Mode

Communication Example

Troubles	Solution
no display	power supply connect well or not, voltage up to standard or not
display wrong or no changes	load cell and its connection wrong or not, wrong setting or input range and other parameter
displayed value not stable	check parameter: increase filter level, choose lower AD conversion rate; signal input range selection too small or not; load cell input signal stable or not; exist external electromagnetic interference or not; load cell damped or not and mechanical shocks or not
no communication	check transmitter address, baud rate, communication interface, host serial No. and serial port normal working. (use communication device to test)

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