Topic: The analog input module connected to a sensor

Applicable model	All analog input modules (DVP04AD-S, DVP06XA-S, DVP06AD-S, DVP04AD-H2, DVP06XA-H2, DVP04AD-H3, DVP06XA-H3, DVP04AD-SL, DVP04AD-E2, DVP06XA-E2, AH04AD-5A, AH08AD-5A, AH08AD-5B, AH08AD-5C, AH06XA-5A), and some CPUs (DVP20EX00R2, DVP20EX00T2, DVP10SX11R, DVP10SX11T, DVP20EX200T, DVP20EX200R, DVP30EX200R, DVP30EX200T, DVP20SX211R, DVP20SX211T, DVP20SX211S, DVP24SV11T2)
Key word	Sensor, analog input

1. Function name / Application occasion

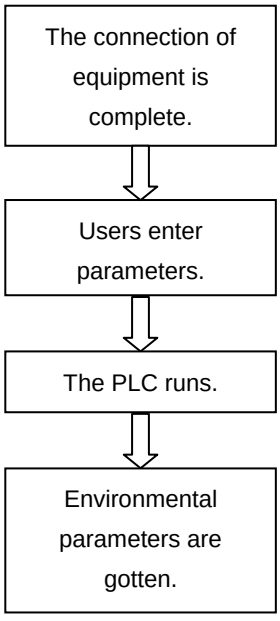
   Installing environmental control equipment in a plant factory:

   Compared with using a sensor which has a built-in communication function, using an anlaog-to-digital module and a voltage/current output sensor can reduce equipment costs, and integrate all environmental parameters to control the environmental parameters in a greenhouse. The parameters which can be integrated in a green house are temperature, humidity, carbon dioxide, acidity/alkalinity, electric conduction, and so on.

   Monitoring environmental parameters:

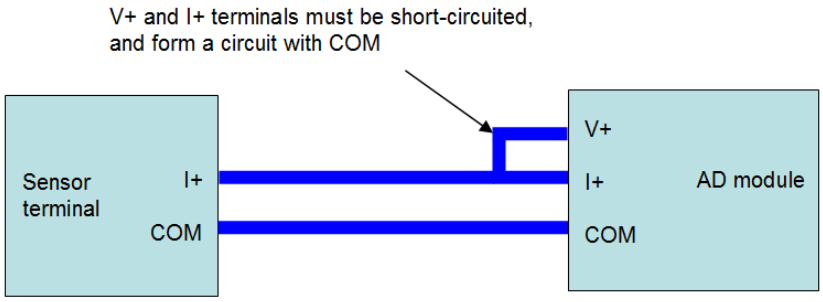
   An anlaog-to-digital module and a voltage/current output sensor can be applied to a weather station or a water quality monitoring station as long as the sensor can output corresponding current or voltage. The parameters that a weather station can monitor are temperature, humidity, carbon dioxide, rainfall, wind velocity, and so one. The parameters that a water quality monitoring station can monitor are temperature, acidity/alkalinity, biochemical oxygen demand, consistency of heavy metal, dissolved oxygen, and so on.

2. Control requirements



Wiring diagram for external hardware:

External Wiring and Terminal Layout



Sensor with current output
Ex:
temperature, humidity, CO2,
PH, electrical conductivity (EC)

3. Descriptions of devices

D0~D150 are used for data storage and operations. Users have to reserve these registers.

Parameters that users need to set:

Register in a PLC	Description
D0	Maximum current passing through CH1
D2	Minimum current passsing through CH1
D4	Maximum physical quantity passing through CH1
D6	Minimum physical quantity passing through CH1
D8	Maximum current passing through CH2
D10	Minimum current passsing through CH2
D12	Maximum physical quantity passing through CH2
D14	Minimum physical quantity passing through CH2
D16	Maximum current passing through CH3
D18	Minimum current passsing through CH3
D20	Maximum physical quantity passing through CH3
D22	Minimum physical quantity passing through CH3
D24	Maximum current passing through CH4
D26	Minimum current passsing through CH4
D28	Maximum physical quantity passing through CH4
D30	Minimum physical quantity passing through CH4
D37	Digital full scale
D97	Number of milliseconds which passes before a sensor detects a value

Parameters that users read:

Register in a PLC	Description
D32	Value read from CH1
D33	Value read from CH2
D34	Value read from CH3
D35	Value read from CH4
D36	Value read from PT

4. Execution of a program

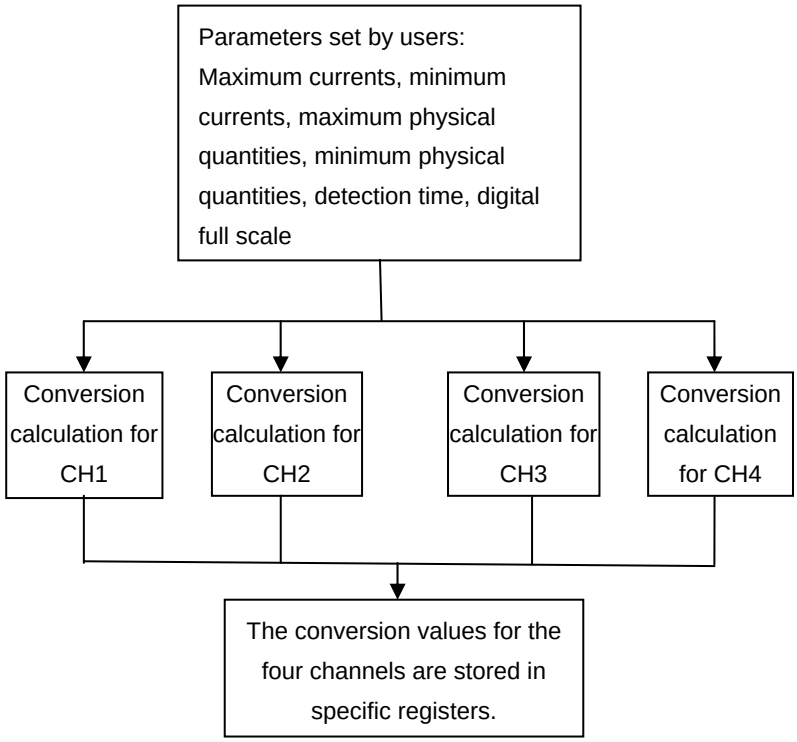
Owing to the sensor used is linear, the main operation used is a linear equation.

First part=((Digital value×Maximum current)/Digital full value)-Minimum current

Second part=(Maximum physcial quantity-Minimum physical quantity)/(Maximum current-Minimum current)

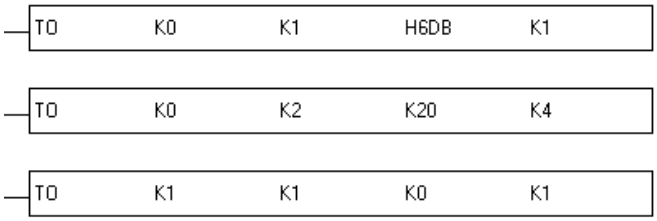
Conversion result=First part×Second part

Structure of a program:



5. Description of a program

Setting 04AD and 04PT:



Desciprtion of the instruction TO:

TO Station address Start CR Value which is written Number of reigsters

Example:

TO K0 K1 H6DB K1

First line: TO K0 indicates the first PLC 04AD. K1 indicates CR#1. H6DB represents the binary value 011011011011. (CH1~CH4 adopts mode 3, that is, an input current mode.) The last K1 indicates that H6DB is written to only one register. (H6DB is written to CR#1.)

CR #	RS-485 parameter address	Latching		Register name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
					Bit switch (CR#1)				CH4				CH3			CH2			CH1	
#1	H'4001	O	R/W	Input mode setting	Input mode setting: The factory setting is H'0000. Mode 0: Input voltage mode (-10V ~ +10V) Mode 1: Input voltage mode (-6V ~ +10V) Mode 2: Input current mode (-12mA ~ +20mA) Mode 3: Input current mode (-20mA ~ +20mA) Mode 4: Not used															

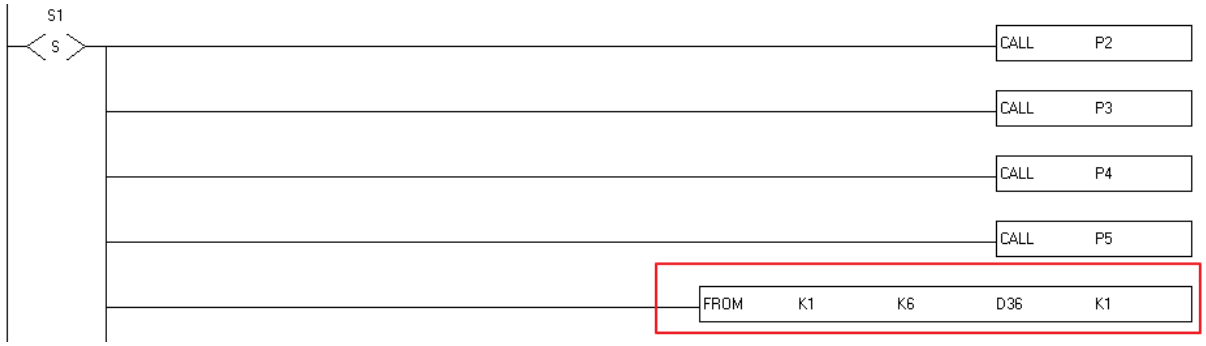
Second line: TO K0 indicates the first PLC 04AD. K2 indicates CR#2. K20 indicates that the number of values which are averaged is 20. K4 indicates that K20 is written to 4 registers. (K20 is written to CR#2, CT#3, CR#4, and CR#5.)

CR #	RS-485 parameter address	Latching		Register name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
					Bit switch (CR#1)				CH4				CH3					CH2					CH1			
#2	H’4002	O	R/W	Number of values averaged for CH1	Users can set the number of values averaged for CH1/CH2/CH3/CH4. Setting range: K1 ~ K20 The factory setting is K10.															
#3	H’4003	O	R/W	Number of values averaged for CH2																
#4	H’4004	O	R/W	Number of values averaged for CH3																
#5	H’4005	O	R/W	Number of values averaged for CH4																

Third line: The thid line is used to set 04PT. In this example, the first PLC is 04AD, andthe second PLC is 04PT. TO K1 indicates the second PLC 04PT. The second K1 indicates CR#1. K0 indicates PT100. The last K1 indicates that K0 is written to only one register.

CR#	Address	Latching		Register name	Description
#1	H’4065	O	R/W	Mode setting	CH1 mode: b0 ~ b3 CH2 mode: b4 ~ b7 CH3 mode: b8 ~ b11 CH4 mode: b12 ~ b15 Take CH1 mode (b3, b2, b1, b0) for instance. The default value is H’0000. 1. (0, 0, 0, 0): PT100 2. (0, 0, 0, 1): NI100 3. (0, 0, 1, 0): PT1000 4. (0, 0, 1, 1): NI1000 5. (1, 1, 1, 1): The channel is disabled.

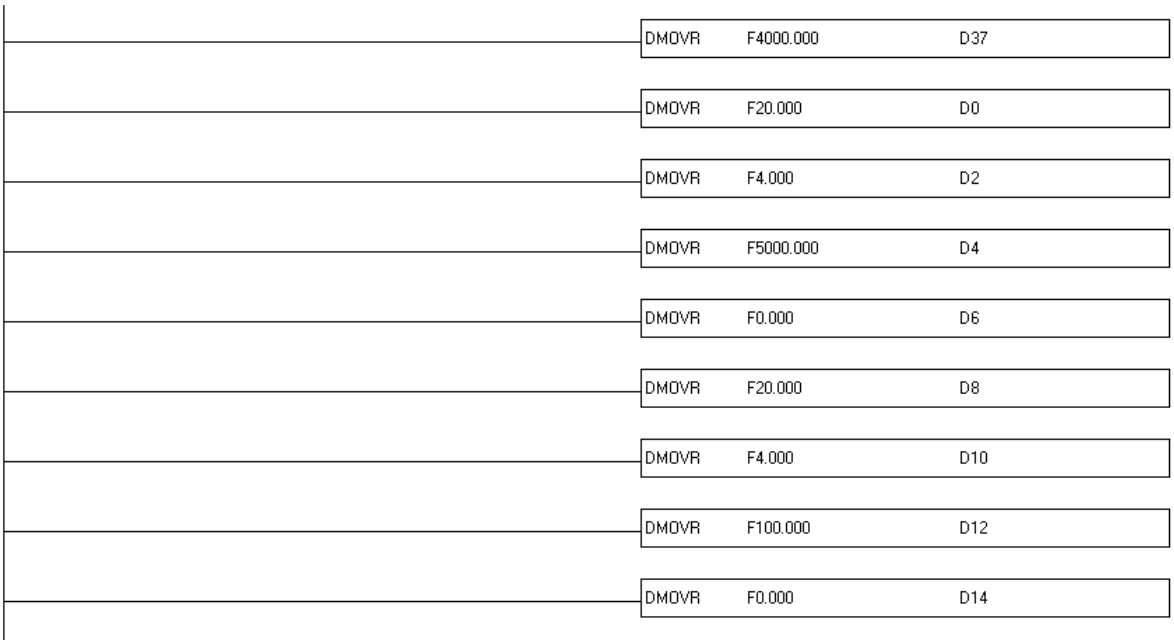
Reading a value from 04PT: FROM K1 K6 D36 K1



FROM K1 indicates the second PLC. K6 indicates that the value in CR #6 is read.

CR#	Address	Latching		Register name	Description
#6	H'4006	X	R	Number of input signals averages for CH1	Users can set the number of input signals averages for CH1/CH2/CH3/CH4.
#7	H'4007	X	R	Number of input signals averages for CH2	
#8	H'4008	X	R	Number of input signals averages for CH3	
#9	H'4009	X	R	Number of input signals averages for CH4	

Parameters set by users:

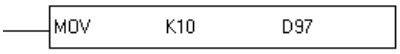


The value in D37 is digital full scale. In this example, the current input range for 04AD is 4 mA~20 mA, the digital conversion value range is 0~4000, and therefore the value in D37 is 4000.

The value in D0 indicates the maximum current passing through CH1, and the value in D2 indicates the minimum current passisng through D2. They are 20 and 4. The valus in D4 indicates the maximum physical quantity passing through CH1, and the value in D6 indicates the minimum physcial quantity passing through CH1. In this example the physical property of CO2 is quantified by measurement. The physical quantity range for CO2 is 0 ppm~5000 ppm.

The value in D8 indicates the maximum current passin through CH2, and the value in D10 indicates the minimum current passsing through CH2. The value in D12 indicates the maximum physical qunatity passing through CH2, and the value in D14 indicates the minimum physcial quantity passsing through CH2. In this example the physical property of humidity is quantified by measurement. The physical quantity range for humidity is 0%~100%.

Setting detection time:



The sensor used detects a value every 10 milliseconds.