Instruction Manual

TYPE DGX1000

Quantification Control System

® SHANGHAI NO.9 AUTOMATION INSTRUMENTATION CO., LTD.

CONTENTS

**READ THIS MANUAL CAREFULLY FOR THE CORRECT USE OF THE
CONTROLLER**

1. General Description

This manual is for the installation, application and maintenance of DGX1000 Quantification Controller designed and made by SAIC No.9 .

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DGX1000 Quantification Controller combined with Flow Sensors (Flow Transmitters) is mainly used in oil, petrochemical and pharmaceutical industries for quantification control and management of material receiving, dispatching and processing. It is also widely used in petrochemical, foodstuff, ship-building and hydraulic machinery industries for flow online measuring and controlling.

Controller Features:

☐ Explosion-proof enclosure is adopted: Class dIIBT4

☐ IP code: IP65

☐ Flow quantitative control accurately

☐ Total Flow, Batch flow and Instant Flow being displayed

☐ Current Date and Time display; convenient and comprehensive data access

☐ Both on-site and remote Supervision & Surveillance are available; two-way-communication interface RS-485, RS-232 ready for on-site or remote diagnosis and surveillance.

☐ Protection of Data: All Settings are hold forever if power failure; Historical data preserved for one year; operational status remains as it was at the time of power failure.

2. Main Technical Specifications

2.1 Basic Functions: Highlighted LED display;
   Measuring Accuracy on-site trimming;
   Metrological Compensation for measuring
2.2 Input: 0~5000Hz Pulse Signal: Wave- form: Square; Amplitude higher than 4V
2.3 Output: 4~20mA; 0~ 5000Hz;
2.4 On-Off Switch Control: Relay Control (220VAC/3A)
2.5 Accuracy: Flow Display: 0.3%FS+/- 1digit:
   Frequency converting: +/- 1 pulse (better than 0.2%)
2.6 Display: 0.000~999999 Batch Flow
   0.000~99999999 Flow Totalized
   0.000~9999 Settings in advance
   0~9999 Density Setting
   0.00001~999999 Coefficient setting
   Optional measuring units: L, kg, m³,T
   Current Date/Time
   Every parameter taken for setting is displayed
   Flow or Valve working status indicating by lamps
2.7 Control Mode: On/Off with Hysteresis, Relay /Contactor for Valve or Pump on/off.
2.8 Setting mode: Explosion-proof key panel for numerical setting: single key shift for multiple
   purpose) .
2.9 Data Protection: automatic Reset for lack of pressure program automatic
   Reset in abnormal working condition (Watch Dog) .
   If power fails, total flow accumulation measured to be kept for one year, while the original
   Settings are hold forever .
2.10 Working environment: ambient temperature 0~40℃，humidity＜100%
2.11 Power Supply: 220VAC 50 HZ
2.12 Explosion-proof Class: dⅡBT4
2.13 Protection Class: IP65
2.14 Power Consumption: less than 5 W
2.15 Weight: 20 kg
2.16 Dimensions: 460×250×230 mm

3. Working Principle (Please to refer to Figure 1)

The output of flow sensor, pulse signal fin, pass through the wave filtering and trimming circuits to the microprocessor for data acquisition that displays the Total Flow on the Numerical Code Display Tubes, meanwhile generates 4 to 20 mA current output signal which denotes the Instant Flow.

Instant Flow:

$$q = f_{in} \times 60/K \qquad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots（1）$$

where:

  q Instant Flow , unit: L/min;
  K flow sensor (meter) coefficient , unit: P/L;
  f_{in} pulse signal frequency from the flow senor, unit: Hz.

Total flow accumulation at the time **t:**

$$Q = N / K \qquad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots（2）$$

where:

  Q the totalized flow at the time t, unit: P/L;
  N the number of pulse generated by the sensor at the time t.

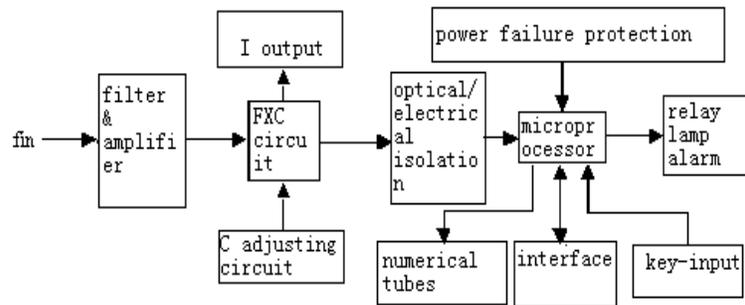The relevant constant settings can be made by Keys on the controller panel .

Figure 1 Working Principle

4. Wiring Diagram

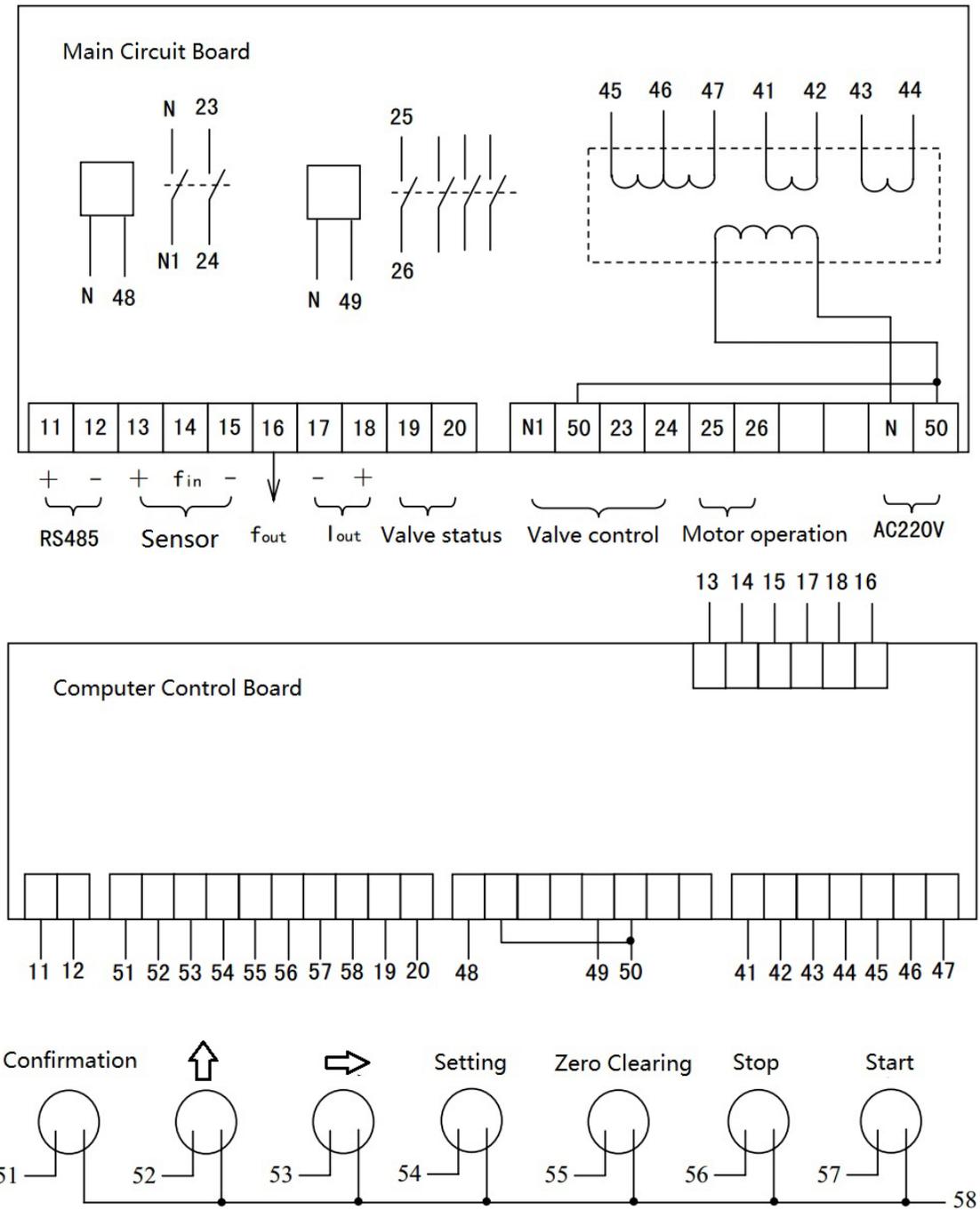Internal Wiring Diagram for Explosion-proof Quantification Flow Controller is as shown on Figure 2

Figure 2 Internal Wiring Diagram for Explosion-proof Quantification Flow Controller

5. Operation & Instruction

1) Display & Panel Key

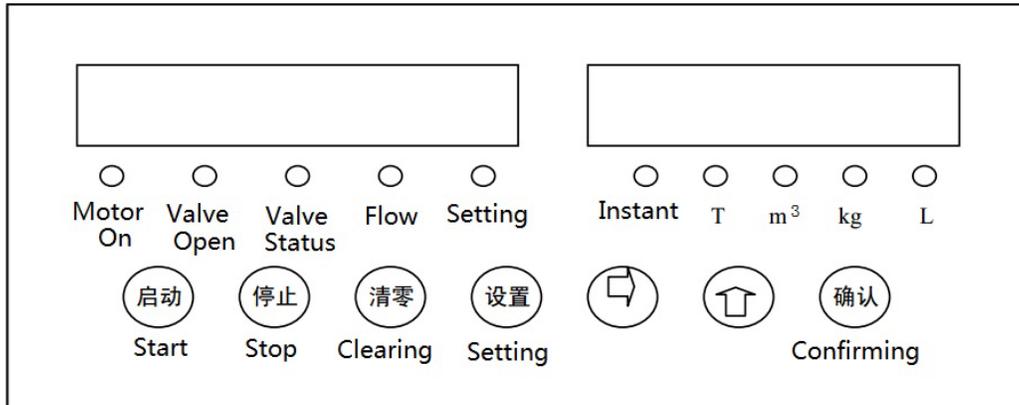The Panel for Explosion-proof Flow Control System is shown on Figure:

Figure 3   Panel for Explosion-proof Flow Control System

There are 2 rows of Numerical Code Display Tubes on the up part of the panel. The left row contains 8 Tubes, and the right 6 Tubes. Under operation the left 8 tubes display the Total Flow accumulated, while the right 6 for batch flow accumulated.

There are also 10 Indication Lamps on the Panel. 4 lamps from the right display the flow units namely "Liter", "Kilogram", "Cubic Meter" and "Ton". Once the Measuring Unit is set, the corresponding lamp will be lit. When the "Instant " lamp is on, that means the right 6- tube -row displays Instant Flow, and the related Instant Flow Unit might be one of the followings: "L/min", "Kg/min", "m³/hr", "Ton/hr"

During the access of "Setting" mode, "Setting" lamp lights. When the flow occurs in the pipe lines, "Flow" lamp flashes. When the Valve feedback signal loops, "Valve tatus" lamp lights. In case the Control Valve Relay within the explosion-proof enclosure is closing, "Valve Open" lamp will be on. If the Control Motor Contactor within the explosion-proof enclosure is closing, "Motor On"lamp lights.

The panel down part contains 7 push-buttons. From the left to the right, they are respectively "**Start**", "**Stop**", "**Clearing**"," **Setting**", " ⇨","⇧" and "**Confirming**" for the Flow instrument operation.

2) Parameters & Setting

There are 15 parameters for the Explosion-proof Flow Meter operation as listed below:

Parameter No.	Range	Instruction
1	0.000~999999	Total Flow of Quantification Control
2	0.000~9999	Quantity in advance for Quantification Control
3	0.00001~999999	Flow Meter Coefficient Unit : Pulse/Liter"
4	-99~99	Control Relay "Start" delay Unit : "Second" *1 If this parameter = "0" , for Quantification Control, pushing "Start" means both relays for "Motor-on" and "Valve-

		open" contacting simultaneously; if parameter>0, means the "Motor-On" Contactor contacting first, "Valve-open" Relay contacting after the set-delay-duration ; if parameter <0, "Valve-open" control Contactor contacting first.
5	0~3	Total Flow accumulated Unit "0" denotes "Liter" ; "1" denotes "Kilogram" "2" denotes "Cubic Meter"; "3" denotes "Ton"
6	0~3	It displays the digit numbers after decimal point for the Flow
7	0~9999	Liquid Density: Unit " grams/Liter
8	0~99	Communication Station Number
9	0~3	Bud Rate for communication: 0=9600; 1=4800; 2=2400; 3=1200
10	0~99	Year of the Clock
11	1~12	Month of the Clock
12	1~31	Date of the Clock
13	0~23	Hour of the Clock
14	0~59	Minute of the Clock
15	0~59	Second of the Clock

*1: In Quantification Control System, if the user only needs operation by valve control, Please take off the Wire marked with #49 from the terminals of the Computer Control Bard, and wrap the related terminal by insulating adhesive tape.

In operation mode (status), pushing "Setting" means to enter the parameter setting mode. In that mode, the left row of Numerical Tubes displays "P" and Parameter No., the right row displays figures of the parameter. During this period, the parameters can be modified by pushing button "↑", and shifted by pushing "→"; if modification is completed, then by pushing "confirming" for storage; instead, if by pushing "Setting", it means to give up the current parameter modification and to enter the next parameter modification. After all parameter (one-by-one) modification is completed, it will automatically return to the operation mode. If the current parameter has been modified and the other parameters that follow after, no longer require modification, pushing the "Stop" button that makes the direct return to the operation mode. After parameter setting is being carried out, and no button is touched for the duration of 15 seconds, the Controller will give up the current modification mode and return to operation mode.

3) Operational Status
When the power is on, the Controller enters to the operational status. Under such status, the left row Numerical Tube displays the total flow accumulated historically, while the right row displays the current flow accumulated.

4) Instant Flow Checking
In operational status, to push the button "↑" is for the Instant Flow checking, in that case, the "Instant" lamp lights, right Tube row displays the Instant Flow; if to push "↑" button again, the controller returns to operational status; if no push, it will also return to the operational status automatically in10 seconds.

5) Quantification Control & Pause Status

In operational status, by pushing "Start" it enters the Quantification Control Status for the liquid quantification control, at the time the batch accumulated flow is renewed from "0" for accumulation.

In Quantification Control mode, pushing "Stop" button will make a pause for the current quantification control operation, that is, in Pause Status. At this time, the "Motor-on" lamp on the Panel is flashing. In Pause Status, by pushing "Start" button to resume the current quantification control; If the "Clearing" button is hold unreleased for 3 seconds, the current quantification control can be cancelled (the record for the quantity already filled is effectively kept)), and it returns to the Operational Status.

6) Time Clock Display

In Operational Status, pushing "Confirming" button means to check the clock, the left row of Display Tube shows "T" and "Year", "Month", "Day", the right row shows "Hours", "Minute" and "Second"; to push the "Confirming" button again for Operational Status return; or it will automatically return to Operational Status in 10 seconds.

7) Total Flow Accumulation Clearing

In Operational Status, to hold the "Stop" button unreleased, then pushing "clearing" button for the duration of 3 seconds, the above action will clear both the Total Flow and Batch Flow accumulated into zero.

In Quantification Control Status, each time when the "Start" button is pressed, the Controller clears the last batch flow to zero, and resumes the control of the next new batch.

8) Self-Diagnosis

In Operational Status, to hold the "Stop" button unreleased first and then hold the "→" button unreleased for 3 seconds, Self-Diagnosis can be implemented.
The Numerical Tube in each digit will display one by one, so the condition "good or bad" for each Tube can be checked. In Self-Diagnosis mode, pushing "Setting" button returns the Controller to Operational Status.

6. Application Example & Adjusting

Project mission/object

Quantitatively to fill 1000 Liters of a certain kind medium fluid with density 1000Kg/m³, into a container; the flow accumulation measuring unit is Liter; only one digit after the decimal point needs to be kept; the user's pipe line nominal diameter is DN50; adopt flow meter Type LHS-50 with meter coefficient 38.02P/l

Here is the configuration and wiring for the pipe lines and instrumentation equipment:
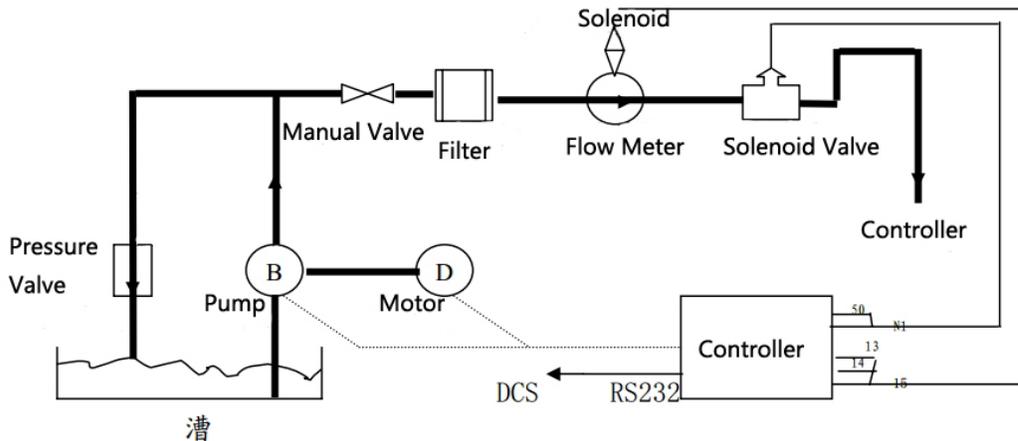
* In this filling

operation, only valve control is needed; please take off the Wire marked with #49 from the terminals of the Computer Control Board, and wrap the related terminal by insulating adhesive tape

Ready for working

Switch the power on, the Controller works, its windows for Accumulation and Batch Flow show respectively the Total and Batch flow displayed last time in the end; for existing "Settings" checking, just push "Setting" button

Parameter Setting

For the instrument operational parameter setting, refer to the instructions on the Parameter Table attached, pushing the "Setting", "Setting" lamp lights;

(1) Set the quantity to be filled in, Accumulation window symbol shows P1 to prompt the setting of filling quantity required this time; by coordinately using → ↑ two keys, to set the batch window to the display of 1000 (unit l); to press "confirming" key for confirmation and entering the next parameter (if give up this setting, just to press the Setting key)

(2) Set the quantity in advance: accumulation window shows symbol P2 to prompt the setting of advanced quantity to be filled in; by coordinately using → ↑ two keys, to set the Batch window to the display of the Advanced Filling Quantity required (unit l; for the initial setting, it shall be "0"; this function is for commissioning/adjusting purpose only); to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(3)Set the Meter coefficient: Accumulation window shows symbol P3 to prompt the setting of Meter coefficient; by coordinately using → ↑ two keys, to set the Batch window to the display of constant coefficient 38.02(Unit P/l) that Meter provides; to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(4) Set the Time Delay for the Relay: Accumulation window shows symbol P4 to prompt the setting of Relay Starting Delay Time; by coordinately using → ↑ two keys, to set the Batch window to the display of required figure, generally it is "0"; to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(5)Setting the Measuring Unit: Accumulation window shows symbol P5 to prompt the setting of current flow measuring unit; by coordinately using → ↑ two keys, to set the Batch window to the display of current unit code "0" (denoting the displayed unit l); to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(6)Setting the digits after Decimal Point: Accumulation window shows symbol P6 to prompt the setting of digits after Decimal Point; by coordinately using → ↑ two keys, to set the Batch window to the display of Decimal digits code "1" (denoting just showing 1 digit after Decimal Point); to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(7)Setting the Fluid Density: Accumulation window shows symbol P7 to prompt the setting of Fluid Density; by coordinately using → ↑ two keys, to set the Batch window to the display of the Density of the medium being measured to "1000" (unit Kg/m³); to press "confirming" key for confirmation and entering the next parameter (if give up this setting, to press the "Setting" key)

(8)Setting Completed: if no further parameter change/modification is needed, just pushing "Stop" button to return the Controller directly to the operational status; instead, if no operation is taken by touching any buttons or keys within 15 seconds, the Controller will ignore all current changes/modifications of parameters and return to the operational status.

Filling
   (1) Running the pump (when Setting is completed; Filling preparation is ready)
   (2) Pushing "Start' key, the System works for filling, the Batch window is showing progressively the Filling Quantity up to Setting (0-1000); meanwhile the Accumulation window is showing the quantity accumulated based on the previously existing figure; relevant indicating lamps are on; once the quantity displayed on the Batch window reaches at the Setting value, the System shuts off the filling valve automatically; at the same time, it opens the pressure valve (if such valve is designed within the system) so as to make the flow in the pipe lines go back. The currently assigned Filling is completed; the actual filling quantity is as shown on the Batch window.

Accident
     If any accident happens or a Pause is needed during the operation, pushing the "Stop" key to stop the current Quantification Control operation temporally and enter into the "Pause" mode. During the time, "Motor-on" lamp on the Controller Panel is flashing. In "Pause" mode, pushing the "Start" button to resume the Quantification Control operation; to hold the "Clearing" button

unreleased for 3 seconds, the current Quantification Control operation can be cancelled (the record for the quantity already filled is effectively kept). The system returns to the operational status .

Adjusting

When filling completed, but the batch window shows the actual filling quantity is, for example, 1012.3, which means it is 12.3 liters more than the Setting, so adjusting   is necessary; Go back to the parameter setting mode P2; by setting P2 to 12.3, then   return to the operational status. Repeat this procedure again, if any deviation exists, until the time when all requirements are satisfied.

7. System Design & Maintenance

1) This company is capable of providing service to customer in reasonably packaged supply of main equipment and pipeline-design as per customer's process parameter and work mission/object.
2) This company is responsible for the service of the system field commissioning/adjusting, so as to transfer a perfectly workable filling system to the customer in good condition.
3) This company is also responsible for users' training for application & maintenance of the filling system.
4) Daily cares and maintenance for all equipment consolidated in this system shall be made by the user according to the requirements written on the instruction manual for individual equipment. The system cares & maintenance can also be contracted by this company or any other competent organization that is qualified in this respect.
5) Keep the meters and instruments clean and prevent it from strong vibration during working.
6) Warranty for this instrument is within one year from the manufacturer's delivery date. In condition that the user is correctly and properly using the instrument as per its instruction manual provided, the manufacturer shall be responsible for the repair free of charge, if any trouble occurs with this instrument.

8. Installation

1) Installation/Mounting style:

      Wall-mounting for the Controller.

2) Mounting holes & dimensions for fixture reference:
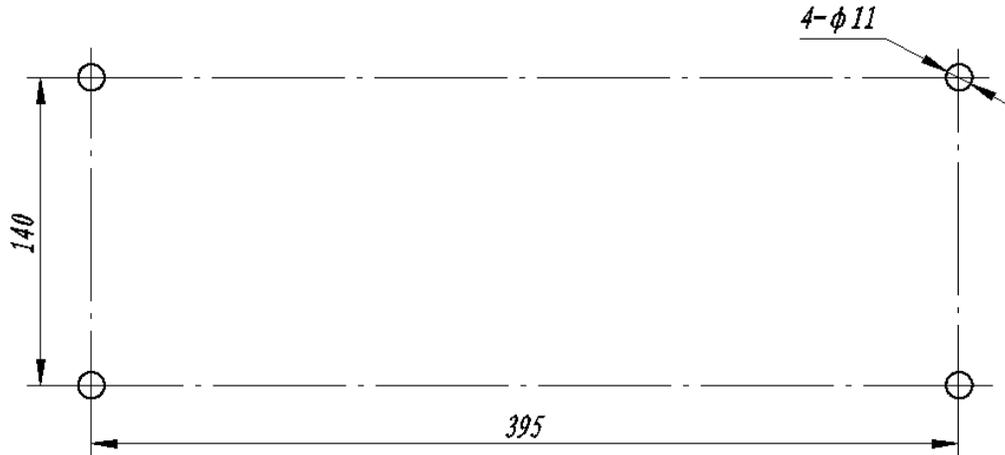
9. Notice for ordering:

1) It is necessary for the users who request the control system to provide us with all information of their work mission/object and the fluid working process parameters.
2) The user shall also detail the job-site conditions (such as pipeline arrangement, pipe nominal diameters, surrounding environment and Power Supply specifications etc.)
3) The user shall also provide the information of mechanical & electrical conditions within its system.

      Prompts: System Type choosing
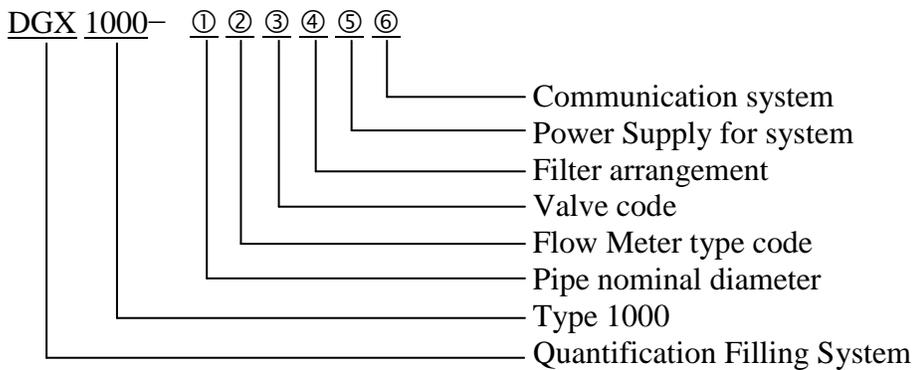
Explanation:

    ① Pipe nominal diameter

    ② Flow Meter Type Code:

        LL   — Roots Flow Meter

        LS   — Rotating-Piston Flow Meter

        LWGY — Turbine Flow Meter

        YF   — Vortex Flow Meter

        LDCK — Electro-Magnetic Flow Meter

LHS   —— Helix Flow Meter
            LB   —— Rotary Vane Flow Meter
            LT   —— Double-Rotor Flow Meter
            LF   —— Mass Flow Meter
            LX   —— other Flow Meters
    ③ Valve code:
            A —— Valves made in China
            B —— Valves imported
            C —— others
    ④ Filter arrangement :
            1 —— with Filter
            2 —— without Filter
    ⑤ Power Supply Code:
            A —— AC 220V,50Hz
            D —— DC 24V
    ⑥ Communication System Code:
            2 —— RS232
            4 —— RS485
Example Type: DGX1000-50LHSA1A2

    Denoting: This is a Quantification Filling Control System within which, Helix Flow Meter with 50mm nominal diameter is adopted, the communication interface is RS232, power supply for the Controller is 220V AC 50 Hz ; the pipe line attached with Filter; domestically-made Solenoid Valve is used.

 The end.

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