BIFFI
tyco flow control

Electronic positioner, microprocessor driven, for modulating hydraulic actuators controlled by an electro-hydraulic proportional valve or by a servovalve

Features and benefits

IPOS is an electronic positioner, driven by a microprocessor, which allows to control the position of modulating service hydraulic actuator by an electro-hydraulic proportional valve or a servovalve, as a function of the analogical electric control signal sent by the process controller. The actuators can be double acting or spring return type.

The wide and long experience acquired by BIFFI in the field of electronic units for actuator position control is the basis for the design and construction of **IPOS**. This positioner was especially engineered for "on field" service in the severest ambient conditions (wide service temperature range, -40°C to +65°C, vibrations, aggressive environment). For this reason BIFFI utilises extended temperature range electronic components which have undergone special protection treatments to make them suitable for aggressive environments (e.g. geothermal plants). Particular care was taken to increase the level of immunity against the disturbs which are always present on industrial plants. The **IPOS** unit is designed to allow and facilitate actuator emergency operations controlled by electric signals from remote control system, by moving the proportional valve spool to the position suitable for emergency operation (fail to open or fail to close or fail in position).

In this way one only valve having both modulating and safety features can be installed at the place of two separate valves (one control, one stop valve) with a significant saving for the Customer. All these features make the difference between **IPOS** and the other positioners available on the market, which are designed and manufactured to be mounted inside a cabinet in a protected environment (limited service temperature ranges and non-aggressive environments). The electronic unit allows the actuator to local controls, position signal re-transmission, alarms, LED's signals, autodiagnostic function, interface to PC. **IPOS** consists of electronic cards suitable to be mounted in a 10" rack for assembly in a control panel or to be mounted in a weatherproof and/or explosionproof enclosure assembled on the actuator or beside it on field. **IPOS** has been designed to be interfaced with the proportional valves and servovalves of the main manufacturers.

General application

- positioning of actuators used in the control of the speed of the turbine in thermoelectric or geothermal or combined cycle power plants

- positioning of actuators used in the control of the water level in the condenser of geothermal power plants

- all those applications where a hydraulic actuator, controlled by a proportional valve, is used in modulating service (e.g. water, oil, gas, pipelines or steam lines in power plants, platforms, docks, petrochemical plants, etc.)

Working principle

The **IPOS** is provided with a P.I.D.-type regulator which compares the actuator actual position signal with the position request signal coming from the process control system. **IPOS** has been designed to control the operation of proportional valves, with one or two solenoids and spool position transmitter or of servovalves. The positioner includes two position regulators so as to achieve a high precision of actuator position control:
- one regulator works on the "internal" loop and controls the position of the proportional valve spool
- the second regulator works on the "external" loop and controls the actuator position.

If the two signals are different, **IPOS** generates a signal proportional to their difference (position error). As a function of the above signal the current to the coil of the proportional valve is increased or decreased, causing the spool to move to control the oil flow to the actuator cylinder: the oil flow and then the actuator operating speed are as higher as wider is the position error.

The configuration parameters are stored in the re-writable and re-configurable EEPROM memory which allows to maintain the configuration also in case of electrical supply failure.

Block Diagram
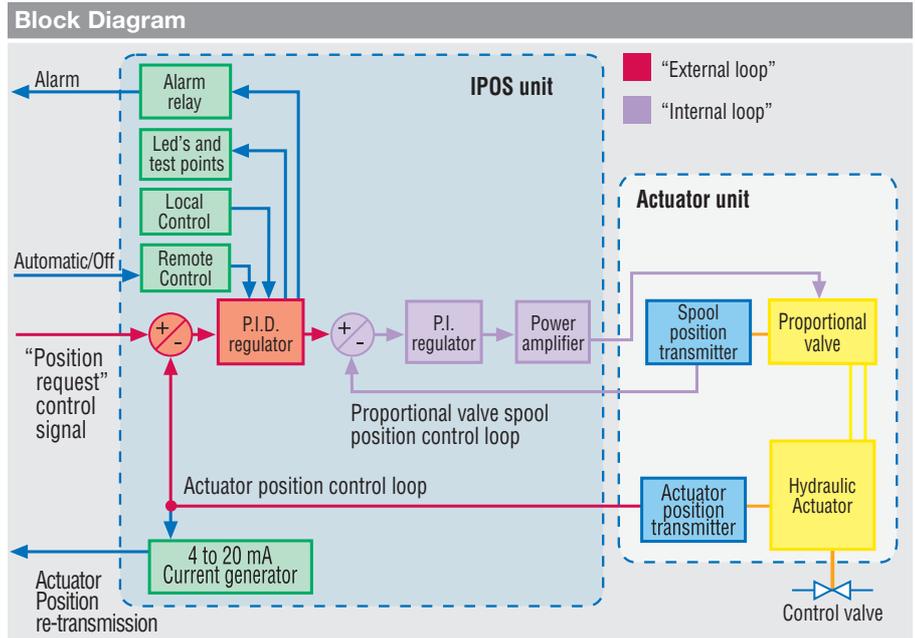
Standard features

Microprocessor digital technique
All functions of **IPOS** are controlled by a 16-bit microprocessor.

Actuator position control
The **IPOS** electronic unit includes two regulators:
- the "external loop regulator" controls the actuator position and computes the position error by comparing the actuator actual position with the control signal called "position request". If the two signals are different, a P.I.D.-type algorithm computes the new position of

the proportional valve spool, so as to move the actuator up to reach the required position and then to nullify the error;
- the "internal loop regulator" compares the spool actual position with the spool requested position signal sent by the "external loop regulator". On the basis of the spool "position error", the current to the proportional valve coil is controlled so as to cause the spool motion. The electro-hydraulic proportional valve controls the oil flow from the supply line to the actuator cylinder or from the actuator cylinder to the oil return line.

Plant Layout
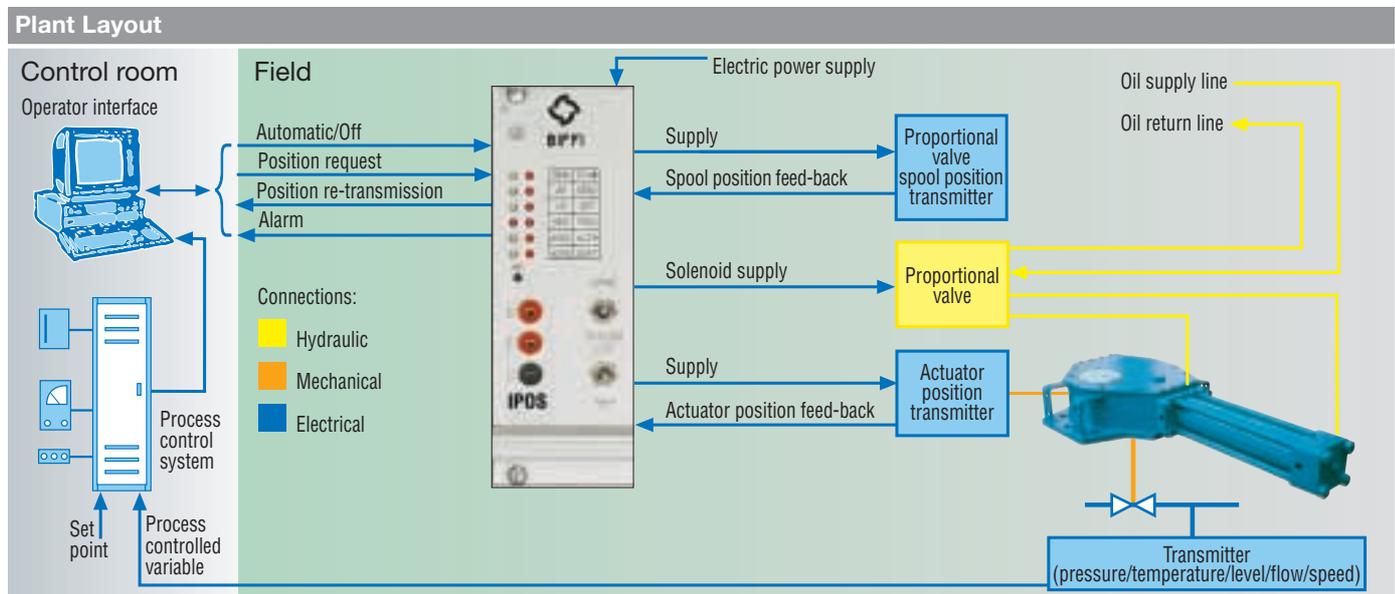
"Position request" control signal

The position request analogical signal can either be 4 to 20 mA or 1 to 5 V type. The input is protected by a galvanic separator.

Positioning accuracy

It corresponds to 0.5% of the position error range, excluding the linearity of the actuator position transmitter and its thermal drift.

Resolution

The actuator resolution corresponds to 0.3-0.4% of the position error range.

Tuning of the actuator position control loop

The following configuration parameters are available and adjustable to optimise the positioning features of the system:
- proportional gain in opening (function P)
- proportional gain in closing (function P)
- integral time (function I)
- max opening speed
- max closing speed

Configuration memory

All the above configuration parameters are stored in the EEPROM memory. Up to 10.000 configuration operations are available.

Actuator position feed-back

The output signal of the actuator position transmitter is used to close the "external loop": it can be 4 to 20 mA or 1 to 5 V. The supply to the position transmitter is provided by **IPOS** itself.

Actuator position re-transmission signal

The actuator actual position can be sent also in control room through a 4 to 20 mA signal, protected by a galvanic separator.

Proportional valve spool position feed-back

The output signal of the proportional valve spool position transmitter is used to close the "internal loop": this signal depends on the model of the proportional valve being used. The supply to the position transmitter is provided by **IPOS** itself.

Remote controls enable

The selector has two positions: "automatic" and "off". In "automatic" (enable) the positioning of the actuator is controlled by the analogical position request signal, while in "off" (disable) the actuator maintains the last position before the switching to "off".

Local controls

A Local/Remote selector and Open/Close pushbuttons are available on the **IPOS** front panel. When the selector is in Remote position the actuator is controlled according to the external position request control signal. When the selector is in Local position the external signal is ignored and the actuator is controlled in opening or in closing by way of the open/close push-to-run pushbuttons: it is then possible to move and keep the valve at the required angular position.

LED signals available on the card

LEDs for the following status or malfunctions are available on the **IPOS** card:
- presence of power supply, opening operation

- closing operation
- position request signal failure
- actuator position signal failure
- proportional valve malfunction
- position error exceeding the preset value during a period longer than the preset time.

Action in case of failure

One of the following actions, which are carried out by the **IPOS** if there is no setpoint or feed-back, may be chosen:
- stay-put of the actuator
- the actuator reaches the open position
- the actuators reaches the closed position

The setting of the fail action is carried out by BIFFI, stored in the configuration memory.

Alarm output

1 output relay with voltage-free contact is available for the remote signalling of any malfunction (i.e. lack of electric supply, positioning failure, position request signal failure, actuator position signal failure, proportional valve spool position signal failure, etc.).

EMC compatibility

IPOS was engineered to meet CENELEC EN 50081-2, EN 50082-2 standards relevant to electro-magnetic compatibility in heavy industrial environments.

Isolation of analogical and digital I/O

All analogical and digital inputs and outputs towards the control room are supplied with galvanic separators (optocouplers, relays, etc.).

Isolation of power supply

The power supply coming from the main line is protected by a line filter and isolated by a transformer or by a DC/DC converter.

Auto-diagnostic function

This feature verifies the correct functioning of **IPOS** and sends the alarm signals when malfunctions are detected.

In-field set-up

Possibility for easy set-up of parameters P, I and D, relevant to the actuator position regulator and to the proportional valve control, in field.

Serial port RS232 for PC connection

A serial port RS232 for PC connection is available. The use of the PC allows to visualise the most important variables, the alarms and to configure the EEPROM memory in a very easy and precise way.

Test points

Two test points are present on the front panel of the **IPOS** unit. They give a signal in the 1 to 5V range corresponding to the position request control signal and actuator position signals.

Local panel

On demand a local panel complete with pushbuttons and selector switch is available, both in weatherproof and explosionproof construction.
One two-digits display shows which variable has been selected (i.e. input signal, position request, integral time, proportional gain) while another three-digits display shows the selected variable value. This allows easy tuning and faults detection.

Cabinet mounting

IPOS consists in a series of electronic cards mounted in a 10" rack (3U height). The rack is usually fitted inside a small cabinet which is either integral with or separate from the actuator. The cabinet can be in weatherproof construction, manufactured in carbon steel, GRP or stainless steel, and/or explosionproof construction, manufactured in cast iron or aluminium. Inside the cabinet are located fuses, a magneto-thermal switch, a line filter and local controls and signals.

Accessory

Extension card allowing **IPOS** to work with the logical card out of the rack. It is very useful during special maintenance.

Recommended spare parts

The electronic cards are made of solid state components and as such they do not require any special maintenance procedure. The following spare parts are anyway recommended for commissioning and two-years' operation:
- one set of spare cards every 5 **IPOS** units
- one set of fuses every 5 **IPOS** units

Technical data

Supply voltage

24 VDC, -15%, +10%.
Any other electrical supply in DC or AC with different voltage or frequency values are accepted.

Operating temperature

-20°C to +65°C (standard version)
-40°C to +65°C (special version with electric heating)

Storage temperature

-55°C to +80°C

Construction

Cards for 10" rack

IPOS-BU-E Rev.0

A.C./Grafiche Malvezzi/3.000/05.96

BIFFC-0128-EN-9506   Contents may change without notice.