HYDAC ELECTRONICS

Control Amplifier
UBS 2111

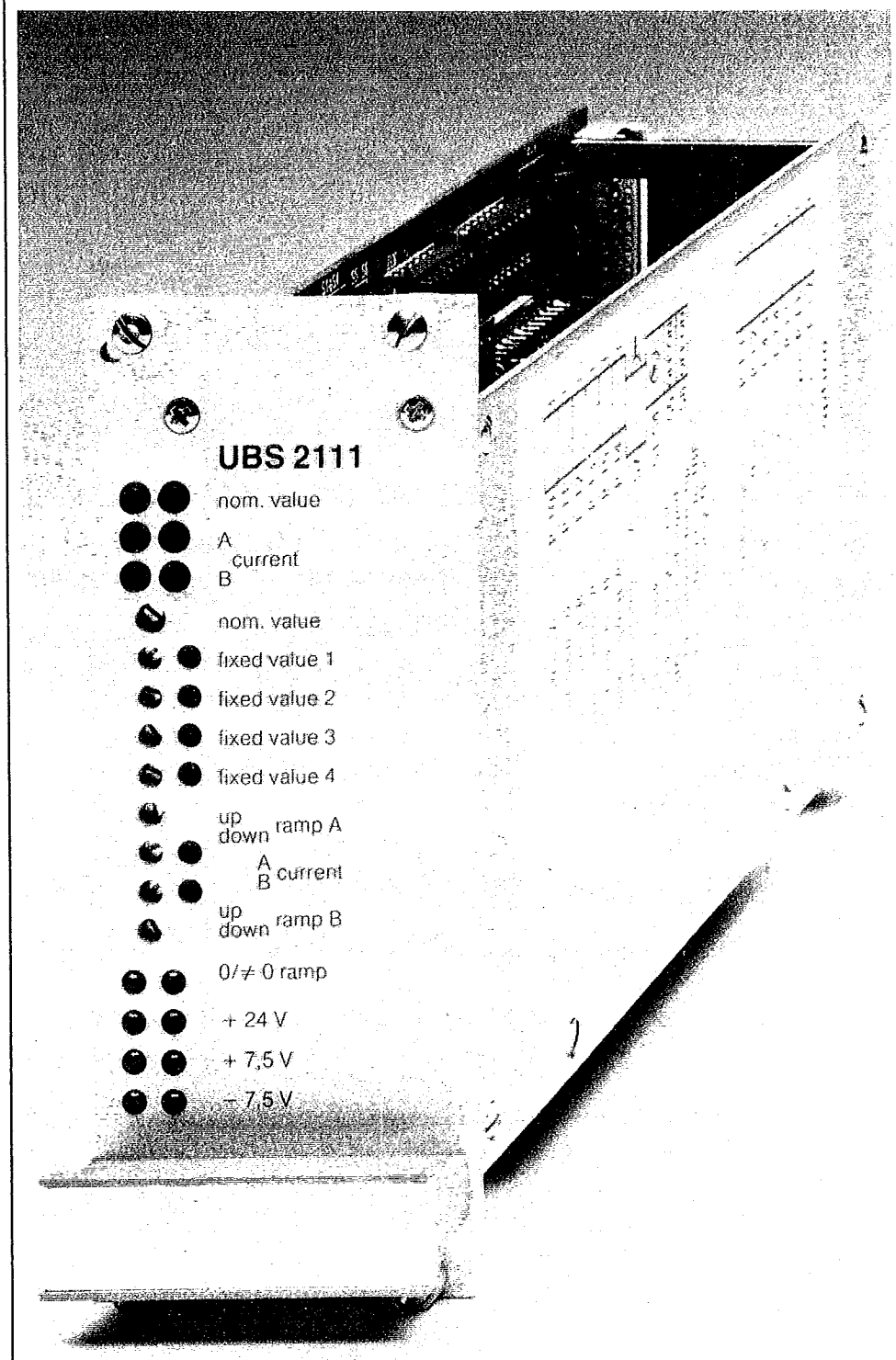
Applications:

The Control Amplifier UBS 2111 is designed for the control of proportional solenoids in all applications. This amplifier can be used for the control of proportional directional valves, proportional pressure relief valves, flow control valves, proportional solenoid actuated pumps and all types of control instruments which are actuated by proportional solenoids.

Standard options are available for special, frequently-used control requirements, eg for speed controls with tachogenerators as feed-back elements, positional controls directly mounted on the proportional solenoids, positional controls etc. Numerous problems can be solved using this system with its extensive range of supplementary cards.

Special features:

- low loss final-stages in compact design
- differential input for the smooth adjustment to external nominal values for either 0...±10 V or ± 20 mA (source or sink)
- 4 adjustable nominal values with digital switching and LED display
- digital time range switchings for ramp functions
- monitor sockets for solenoid currents and nominal values (ramp output) (front plate)
- LED status display for power supply
- LED display for solenoid outputs with proportional brightness
- relay output for ramp or nominal value zero
- standardised to 19" rack system
- compact design: 10 TE Europa format
- extensive range of accessories



Design:

Voltage supply:

The control amplifier UBS 2111 requires a supply voltage of 24 V DC ± 10 %. The residual ripple can be up to 49 %. This corresponds to full wave rectification of an AC single phase power line.

From this 24 V supply, a stabilised voltage is generated within the assembly which is required for supplying the integrated components and the external nominal value regulators and additional cards. These operating voltages set at ± 7.5 V, and the internal reference point, IRP, are fed to the connection block of the control amplifier.

Red and green lamps on the front plate of the amplifier indicate the state of the internal power supply.

Inlets:

a) analogue inlets

In addition to the potentiometer inlets 1 and 2 for 1-channel and 2-channel models with ramps, the control amplifier UBS 2111 has another analogue inlet 3, which bypasses the ramp and gives the nominal value directly to the final stage. For potential-offset compensation between inlet voltage and internal operating voltage, the UBS 2111 has a floating differential inlet which can be used via a slider switch either as a voltage inlet or as a current inlet.

b) digital inlets

The control amplifier has four independent settings for fixed value outputs and two variables for ramp slope selection. It is possible to choose the type of control (PNP or NPN transistor switches) by means of a code-switch, thus determining whether the fixed values are selected using positive or negative logic.

Fixed values:

The fixed value settings are pre-set nominal values which can be adjusted on the card and can be selected externally. The fixed values can also be pre-set using external potentiometers. On the UBS 2111 there are four fixed value setting possibilities. When the corresponding fixed value is selected, the relevant LED indicator lights up.

Any permutation of fixed values can be selected. The resultant nominal value is the sum of all selected nominal values including the nominal values at the differential inlet 1, at the potentiometer inlet 2, and at the direct inlet 3. This combination facility provides the solution to numerous special problems.

The matching of fixed values to the solenoid outlets and the choice of type of switching (PNP or NPN) is achieved by means of a hexadecimal code-switch with 16 positions. The variables are listed in the detailed manual.

Ramp former:

The ramp former (integrator) has the function of reducing the rate of current increase in the solenoid when it receives a step function signal on its nominal value inlet.

With a ramp former, therefore, in the case of rapid changes on the nominal value potentiometer or superimposition of fixed values, the setting speeds of the hydraulic control element and therefore the acceleration or deceleration of the hydraulic user (cylinder, hydraulic motor etc) can be limited.

The ramp generator is so designed that in each direction of movement the acceleration and deceleration can be adjusted independently of each other. On the front side of the card four ramp potentiometers are accessible for this. The ramp time value is always based on 100 % of the nominal value input. In the case of a smaller step input the ramp time is reduced proportionately. This has the effect of giving a constant rate of change of solenoid current and hence a constant hydraulic velocity, whatever the size of the step input.

In the standard model ramp times are available in the range 1 - 10 seconds. By altering the time range selections the following ranges are available:

0.20 sec – 2.00 sec
0.03 sec – 0.30 sec
0.02 sec – 0.20 sec

The variable inlets are controlled by the ramp former in exactly the same way as the fixed values.

Function former:

The proportional solenoid converts an electrical signal (current) into a proportional force on the armature. In practice, the proportional region only starts at a certain modulation of the solenoid current, ie the valve does not open until approx. 20 % of the nominal current is fed to the corresponding solenoid. For the transition from one direction of movement to another there is a standstill in the return of current in channel A which lasts until the increasing current in channel B has reached 20 % after passing through zero. This delay or "dead zone" which results from the distance the solenoids must cover, is kept as short and as stable as possible with a function former. At the same time the initial inverse current and the maximum current are set via the function former.

Base and initial inverse currents:

The initial setting of the base current is done by the manufacturer ar approx. 75 mA; the "initial inverse current" is pre-set at 150 mA. The base current is approx. 40 - 50 % of the initial inverse current. The initial inverse current must be adjusted so that the valve opening is just set at quiescent operating point when there is no signal at the amplifier inputs.

Final stages:

The power stages function using a chopper technique, ie the outlet signal is a switching signal with fixed frequency (160 Hz) and variable pulse width.

The control of the current, largely independent of temperature, solenoid resistance, working voltage output resistance etc, is effected by altering the switching duty ratio.

The advantage of this technique lies in the low loss control which means high efficiency. As there is very little temperature rise in the unit itself, it is suitable for use in high ambient temperature conditions. This method of control using Pulse Duration Modulation also obviates the need to superimpose a dither signal on the solenoid current.

Monitor sockets, LED displays:

Three double monitor sockets on the front plate of the amplifier can be used for checking actual values during operation of the card without interrupting the function.

On the nominal value monitor sockets there is the nominal value which is adjusted to the ramp former, ie it consists of fixed value settings, differential inlet voltage or differential inlet current.

A monitor voltage of ± 5 V corresponds to an input signal of 100 % of its nominal value. A positive nominal value refers to channel A, whilst a negative one refers to channel B.

The current monitor sockets allow the current in each solenoid to be measured without interruption.

A mean value filter enables monitoring via a simple multimeter.

The data signal is 1 V for every 1 A solenoid current. All data signals are fed to the terminal strip.

In addition to the monitor sockets there are LED displays on the front plate which make it possible to check in which channel current is flowing. The brightness of these LEDs is more or less proportional to the solenoid current.

For further control, readings of "nominal value" or "ramp in zero" and "ramp not equal to zero" are available on the card via LEDs.

LED "ramp in zero" indicates that no nominal value has been set for the ramp time constants.

Positioning control:

It is often advantageous to operate the electro-hydraulic positioning element within a feed-back control circuit to increase the positioning accuracy and to minimise the effect of disturbing forces such as friction and flow forces. In this case the movement of the positioning element (solenoid armature or control element in the valve) is measured by means of a suitable LVDT, fed back to the positioning control and compared with the pre-set nominal value. The positioning control output controls the magnetic current in the solenoid to such an extent that the required position is very accurately set and held despite fluctuations of disturbing forces.

By fitting the controller card UBS 2012 into the control amplifier UBS 2111, controls of this kind can be achieved. The data amplifier module which is built onto the UBS 2012 evaluates the signal of the LVDT and sends a voltage signal (the actual value) to the controller.

The controller card UBS 2012 can also solve a wide variety of PID-type control problems. Any necessary signal analyses can be carried out in a special module, enabling the user to select the pre-set P, I and D proportions to optimise the system response according to his requirements of overshoot, response time and steady state error.

Ordering details:

UBS 2111 - X X X X - XXX

Electronic amplifier for proportional valves

- 0 with one output outlet (A)
- 1 with two output outlets

- 0 without ramps and fixed values
- 1 with ramps and fixed values

- 0 without positioning controller
- 1 with positioning controller
- 2 with controller without LVDT data amplifier

- 0 without plug card block
- 1 with plug card block

Modification number
(determined by manufacturer)

Please order special models separately.

Design note:

When the UBS 2111 component is incorporated in the plug card block, the connection points 5 a - c, 7 a - c, 9 a, 11 a, 13 a - c and 15 c cannot be used.

If special functions are required, the UBS 2111 must be connected to a 64-pole plug connector.

Ordering details for accessories:

Precision potentiometer
1 – turn with knob and self-adhesive scale disc
UBS 2501

Precision potentiometer
3 – turn with setting knob and fixing screws
UBS 2502

Precision potentiometer
10 – turn with setting knob and fixing screws
UBS 2503

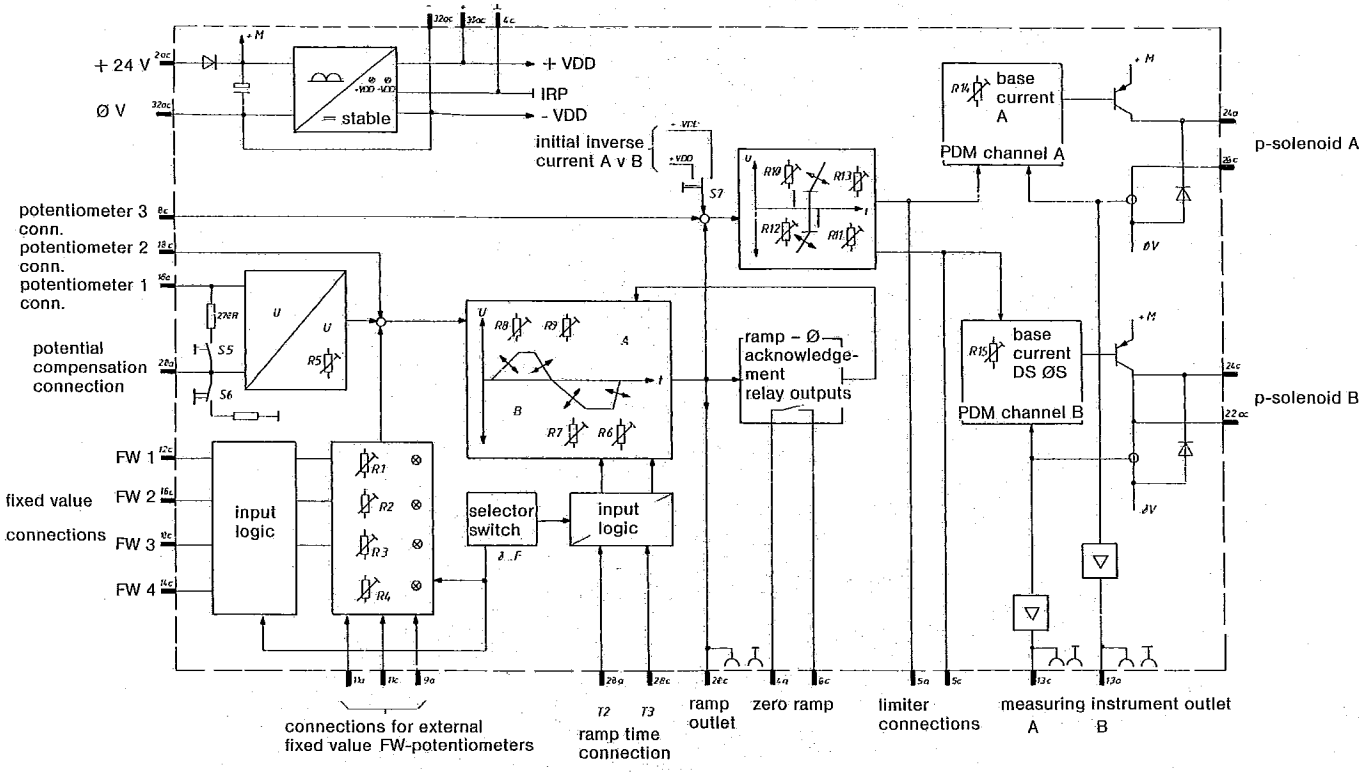
Plug card block
32 – terminals, even-numbered a and c
UBS 2504

Adaptor
for setting functions and measurements in 19" unit
UBS 2013

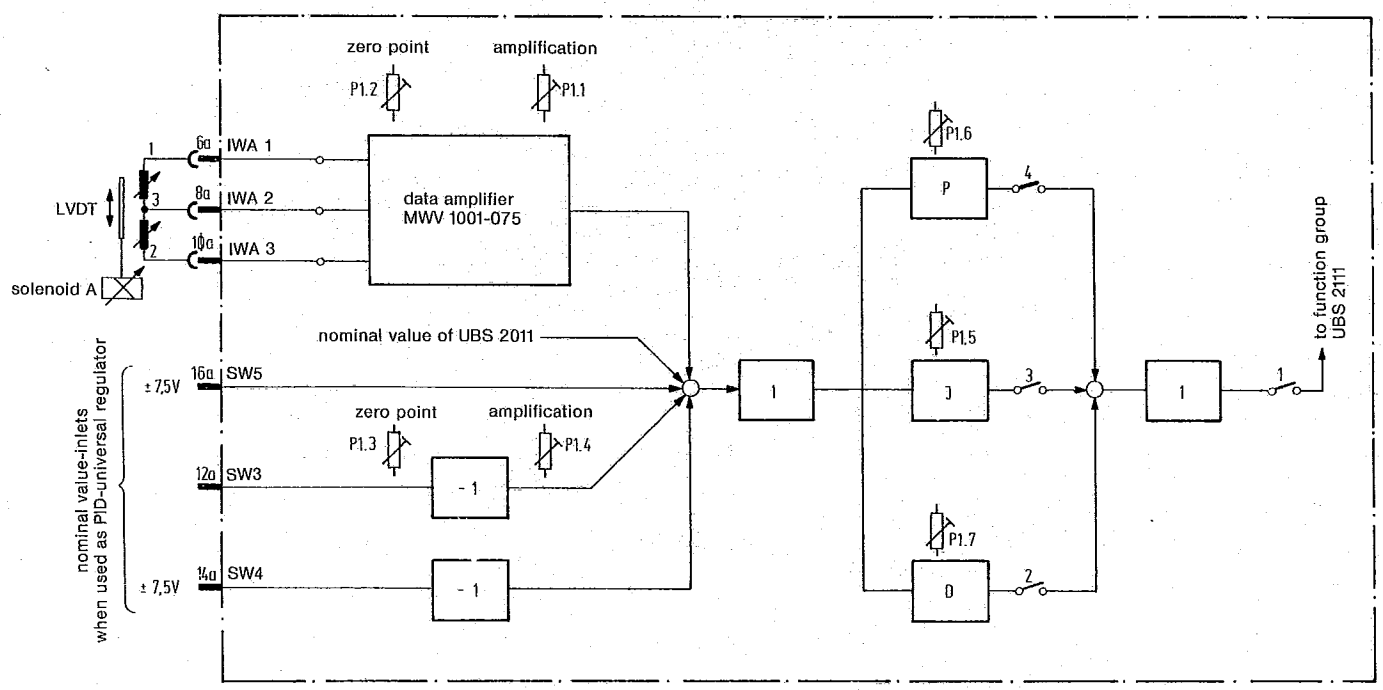
Technical specifications:

Supply voltage:	Full bridge supply 24 V ± 10 % Battery supply 20 . . . 36 V Three phase current 22 . . . 32 V
Input power:	Approx. 40 VA max. at full control
Fuse:	2 AT/250 V, 5 x 20, DIN 41571
Outputs:	Controlled current 0 . . . 1.6 A Pulse width modulated signal, 160 Hz
Base current:	0 . . . 500 mA individually adjustable
Initial inverse current:	I-base + 50 . . . 350 mA individually adjustable (50 . . . 850 mA setting range for fundamental current = I-base + I-initial inverse)
Maximum current:	Fundamental current + 0.2 . . . 1.1 A maximum 1.6 A individually adjustable
Dither signal:	Results from cycle frequency of 160 Hz
Differential inlet:	0 . . . ± 10 V or 0 . . . ± 20 mA reversible
Ramp time changes:	Approx. 1 . . . 10 sec at 100 % of nominal value; 0.20 . . . 2.00 s 30 ms . . . 0.3 s 20 ms . . . 0.2 s
Internal operating voltage:	± 7.5 V
External load through nominal value positioners and additional components:	50 mA between + 7.5 and − 7.5 V 30 mA between IRP and + or − 7.5 V
Relay output:	40 V max. 10 VA
Monitor sockets:	Nominal value ± 5 V corresponds to ± 100 % nominal value; Current measurement: 1 V corresponds to 1 A
Connection for LVDT:	Carrier frequency voltage 7 V_{SS}, 5 kHz amplitude stabilised Load capacity 300 mW max. external load
Permissible ambient temperature:	− 10° C to + 70° C
Dimensions:	19" slide-in unit 3HE-10TE for 19" unit carriers to DIN 41494 and IEC 297
Connections:	Plug connector, 64-pole, to DIN 41612 Type of construction: C

Block circuit diagram UBS 2111:



Block circuit diagram UBS 2012:



Subject to technical alterations