*Servo***SPATZ***M600LL/M600LW High-Tech Controller*

The high-tech controller *Servo***SPATZ***M600LL/M600LW* is a 1,000 Hz-medium-frequency inverter power source with integrated servo drive control. In combination with external medium-frequency transformers and brushless AC or DC servo motors with spindle drive, *Servo***SPATZ***M600LL/M600LW* is a powerful, inexpensive solution for resistance welding units in the welding current range between 3 kA and 30 kA. The power output stages of both drive axles possess - at an intermediate circuit voltage of 560 V - a peak current of 17,5 A for the electrode force drive and for welding gun equalisation. With its scope of functions, *Servo***SPATZ***M600LL/M600LW* is especially designed to meet the demands of automated serial production in car body construction.

The integration of the drives into the welding control is advantageous. It also facilitates the process sequence-determined control of electrode force, electrode displacement and equalisation force. Moreover, the force and displacement measurements allow the optimisation of gun closing time and force build-up speeds.

Each welding is controlled during the welding process. The control process on the welding power source is carried out as fast as possible within the time period of the 1 kHz medium frequency. A comparison between actual values and target values is carried out every 0.5 ms. The control process of the servo drives is regulated at a 16 kHz clock frequency every 125 µs. If the set parameters are not met, the power is adjusted during the running welding process. The applied control technique is the adaptive *Servo***-MASTER** control method. Constant Current Control (CCC), Constant Power Control (CPC) and Constant Voltage Control (CVC) are also at disposal.

The *Servo***SPATZ***M600LL/M600LW* high-tech controller is connected via 2-wire Bus with the *Servo***SPATZ***GM1* gun module which is mounted on the welding gun or the welding machine. This gun module preprocesses the sensor signals for the welding current, the electrode voltage and, if necessary, for the electrode force and the electrode displacement. Encoder- or resolver signals of the servo motors are, moreover, processed and, together with the sensor signals, transmitted via the 2-wire Bus to the *Servo***SPATZ** controller. Doing this, the high number of signal lines which is required especially by servo drives is minimised and the susceptance to disturbances is reduced.

Technical Data

Welding spot selection	28 Bit (max. 268.435.456 spots)
Number of programs	127
Welding impulses / Program	16
Control methods	**MASTER**, *Servo***-MASTER,** CCC, CPC, CVC
Force program	yes
Sensor monitoring	yes
Limit value monitoring	yes
NUGGET*Index*	yes
Automatic limit value determination	yes
Tip dresser control and supervision	yes
Welding data recorder	yes
Interfaces	*BG-02*, RS232, GM-BUS, PROFIBUS-DP, ETHERNET
Welding Inverter	
Mains voltage U_1	3~400 V - 500 V, 50/60 Hz
Max. power S_{max}	300 kVA at 400 V
Nominal power S_N	150 kVA with 20 % DC, 400 V 90 kVA with 50 % DC, 400 V
Output voltage U_{2N}	500 V / 1,000 Hz
Output current I_{2max}	650 A
Supply Voltage DC	24 V DC / 5 A
Drive axles	2
Servo Module *Servo***SPATZ***SM* **for Electrode Force**	
Intermediate circuit voltage U_{2N}	560 V
I_{2N}	10 A
I_{2max}	17,5 A
Servo Module *Servo***SPATZ***SM* **for Equalizer Motor**	
Intermediate circuit voltage U_{2N}	560 V
I_{2N}	10 A
I_{2max}	17,5 A
I/O Module *Servo***SPATZ***IO-24-16*	
Digital inputs	24
Digital outputs	16
Analog inputs -10 V to 10 V	1
Analog outputs -10 V to 10 V	1
Cooling system *Servo***SPATZ***M600LL*	air cooled ambient air temperature max. 40 °C / 104 °F
Cooling system *Servo***SPATZ***M600LW*	water cooled 2 l/min at 20 °C - 25 °C, max. 10 bar 0.5 gal(US)/min at 68 °F - 77 °F, max. 145 PSI
Pressure drop	< 150 mbar at 12 l/min < 2.2 PSI at 3.2 gal(US)/min
Type of protection	IP20
Dimensions (H x W x D)	300 x 390 x 340 mm 11.8 x 15.4 x 13.4 in
Weight	36.6 kg /80.7 lb

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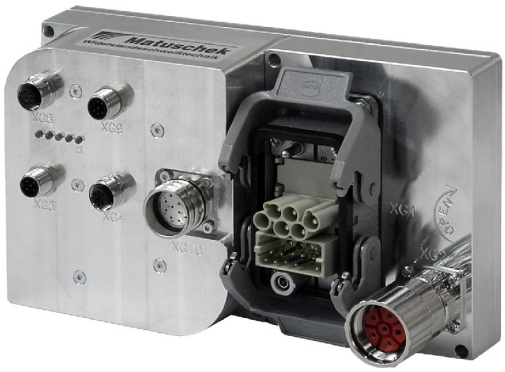
The information which is required for operating a welding gun is stored in a data memory which is integrated in the *Servo***SPATZ***GM1* gun module, the so-called intelligent welding gun identification system **MASDAT.**

(EU Patent No. 0947279B1, US-Patent 6,072,146).



Technical Data *Servo***SPATZ***GM1* **gun module**

- 2 resolver inputs
- 4 digital inputs (24 V DC)
- 4 digital outputs (24 V DC), max. per 500 mA
- 4 analog signal inputs for: electrode voltage, welding current, electrode displacement and electrode force
- integrated welding gun identification system **MASDAT**
- external 24 V voltage supply

Every time the system is switched on or every time the welding gun is changed, the data are automatically transferred to the high-tech controller.

All welding program data, **MASTER** reference curves, motor parameters, geometry data and other maintenance and machine information data which are required for the operation of a specific welding gun are thus stored in the *Servo***SPATZ***GM1* gun module. All servo guns or machines which are equipped with the gun identification system can be operated with any high-tech controller and without repeated pre-operational work. The welding guns can be programmed “offline” by the gun manufacturer or by the maintenance staff, thus weld parameter determination in the line is no longer necessary.

The control and the medium-frequency inverter of *Servo***SPATZ***M600LL*/*M600LW* are housed in a compact, IP20 case which has a total weight of 36.6 kg / 80.7 lb and which is designed for inexpensive installation in a switch cabinet.

For the fast I/O communication with higher-level devices - e.g. robot control unit or line SPS - a PROFIBUS DP interface is available. Alternatively, 24 additional digital inputs and 16 outputs on the *Servo***SPATZ** I*/O* module ensure reliable data exchange via standard logs with 24 V DC signals. The module is, moreover, equipped with one analog input and output.

Online-Programming, analysis and diagnosis are the connecting links between production, quality control and process engineering. There are three possibilities: The handy graphic operating device **SPATZ***BG-02* meets the demands of rough production conditions. Via the *Servo***SPATZ** RS232 interface and by means of a notebook and the PC software *Servo***STUDIO** the user is provided with further detailed information. The ETHERNET interface in connection with the line PC software *Servo***STUDIO***NET* allows the cross-linkage of all welding operations with a line and/or industrial computer.

The representation of the process signals welding current, electrode voltage, power, electrode force and electrode penetration provide the welding expert with important process information for setting the welding parameters. The recorded values of the weldings and the graphic representation of the measured value trends are a useful means for the operators and for maintenance staff in order to ensure the weld spot quality.

All 8,000 welding data sets of the welding data recorder which is integrated in each *Servo***SPATZ***M600LL*/*M600LW* can be read and stored by means of the operating units. Each data set contains, apart from the measured values, also a time stamp and information about limit value violations and error status. Permanent data storage is possible with the line PC-software *Servo***STUDIO***NET.*

The offline analysis of the welding data sets with the **SPATZ***QS* PC evaluation software or standard programs, such as spreadsheet programs, informs quality control about the present process status and the process development.

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