FIBER OPTIC SYSTEM (LWL)

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1. GENERAL

Plastic fiber optics is used for the data communications between the components of the welding plant. They provide the connection between the service PC and the welding control units SC4.0M. By the use of fiber optics, interference sensitivity and a galvanic separation of the individual welding components is achieved. The fiber optic (LWL) is connected to the serial interface of the PC by means of an RS/232 connecting plug; it operates at a transfer rate of 9600. In order to achieve data transfer rates of 14400 and 28800 Baud, the service PC must be fitted with a DT2 interface hoard.

The distribution of the optical fiber to several welding control units is carried out by LWL distribution boxes (LLV.V / 9S, LLV.V / 16). The LWL distance between the PC and an LWL distribution box or between two LWL distribution boxes must not exceed 50m and the network can be implemented with a maximum cascade depth of three levels. More details are contained in Section Interconnection examples. The attenuation of the plastic optical waveguides used must be <=200 dB. Several points must be strictly observed in the handling of optical waveguides to ensure an interference-free and reliable data exchange connection. A detailed description is contained in Section Assembly of LWL.
2. FIBER OPTIC COMPONENTS

2.1 LLV.V / 9S

The LLV.V / 9S (Fiber optics distribution box. Connection of nine welding control cabinets) is used for the distribution of fiber optic signals. The LLV.V / 9S is connected to the service PC via two LWLs. The LLV.V / 9S is fitted with transmitting and receiving modules from Hewlett Packard. The fiber optics from the service PC are connected by the plugs X6 (receiver, blue) and X7 (transmitter, grey). All other receiver/transmitter pairs (X8 X9, X10 X11,…… X22 X23, X24 X25) are outputs; i.e. they can be connected to further LLV.V / 9S or LLV.V / 16 via LWL. The red LEDs indicate transmission by the connected welding control units. For this application of the LLV.V / 9S, switch S2 must be closed and switch S1 set to position 1 (to the transformer). A further LLV.V / 9S or LLV.V / 16 can be connected in series via plug X3 with the appropriate connecting cable. An LLV.V / 9S to which others are connected must have the following switch settings: S2 open and S1 in position 2. The plug casing X6 and X7 are not connected in both distribution boxed in this mode of operation.

The LLV.V / 9S is supplied with 230V/50Hz via a four-pole CombiCon plug. The green LED indicated the mains connection. The LLV.V / 9S is fused by a fast-blow 0.4A/250V microfuse. The following sketch shows the position of the most important components.
2.2 LLV.V / 16

The LLV.V / 16 is conceived exclusively for fitting in a control cabinet. 16 welding control units can be connected to the optical fiber system using the LLV.V / 16. The entering optical fibers are connected to the plugs X6 (receiver) and X7 (transmitter). Via the plugs X8 and X9, the optical fiber signals can be distributed to a further LLV.V / 9S or LLV.V / 16. Additionally, a further LLV.V / 9S or LLV.V / 16 can be connected by plug X25 and the corresponding cable. By this means, the connecting capacity of a control cabinet can be increased. The welding control unit SC4.0M is connected electrically to X10 to X25 by a fivepole Combicon plug. The distance between the LLV.V / 16 and a welding control unit SC4.0M must not exceed 15m.

Power supply and fusing is the same as in the LLV.V / 9S.
3. LWL INTERCONNECTION

3.1 PLUG CONNECTION

The optical fiber distribution boxes LLV.V / 9S and LLV.V / 16 are fitted with receiver/transmitter modules designed to take LWL plugs. The receiver is blue and the transmitter is grey. The LWL plugs are connected as follows to this transmitter and receiver module.

The connections to the transmitter/receiver modules are color coded by blue and grey LWL plugs. Other colors may also be used, as the plugs are mechanically identical. The following illustration shows the interconnection with color coded plugs.
The transmission line from the RS232/LWL connecting plug is connected by the blue plug and the receiver line by the gray plug. The plugs are connected to the sockets of the LLV. V / 9S with the corresponding colors. On the RS232/LWL plug, the transmitter is marked with T and the receiver with R. One line is fitted with a blue plug and the other with a grey plug on the outgoing LWL cable. Lines with a grey plug at one end are fitted with a blue plug at the other, and vice versa.

Please note that the lines are crossed in all connections.

The following possibilities can be used to discern the transmission and reception fibers: connect the RS232/LWL connecting plug to the network but not to the PC. The transmitter diode in the connecting plug now transmits permanently. Looking into the ends of both cables, the transmitter line is illuminated. If the LWL is connected correctly to a LLV. V / 9S, all transmitter outlets are illuminated and the transmission line can be followed in this way.
3.2 INTERCONNECTION EXAMPLE A

Cabinet 2

32 cabinets

Cabinet 1

16 cabinets

Supply 230V/0.4A

Interface board DP2

RS232/LWL Adapter UN3961BP

Service
The RS232/LWL adapter is inserted in the DP2 interface hoard. An LLV.V/9S is connected for the central distribution of the incoming LWL. In this example, two control cabinets are connected to the LLV.V/9S, by which seven more are possible. An LLV.V/16 must be used for the connection of 16 welding control units in control cabinet 1. If, as in cabinet 2, 32 control units are to be connected, a second LLV.V/16 must be connected in series to the first.

Attention:
- All LWL line sections must not exceed 50m in length.
- In the network, the cascade depth must not exceed 3 levels. In this example, the LLV.V/9 is the first and the three LLV.V/16 connected to the LLV.V/9S arc the second level. If the series-connected LLV.V/16 in cabinet 2 were not connected electrically, but by LWL, this would represent the third level.

An interference-free data transfer cannot be guaranteed if these rules are ignored.
3.3 INTERCONNECTION EXAMPLE B

Cabinet 2
- 32 cabinets
- Interface board DP2
- Supply 230V

Cabinet 1
- 16 cabinets
- Supply 230V/0.4A per LLV/9S

RS232/LV Adapter UNZ297-1B

Service PC

→ 9 cabinets

Per LLV/9S
Supply 230V/0.4A

In this example, the outgoing LWL from the RS23/LWL adapter is guided directly into a control cabinet and connected to an LLV.V / 16. Connected to this via plug X25 from an LLV.V / 16 and plug X2 from an LLV.V / 9S is a further LLV.V / 9S. In this case, the switch settings of the LLV.V / 9S must be adjusted as follows: S1 open and S2 in position 2. To this following LLV.V / 9S, nine control cabinets can be connected (X8 X9,……, X24 X25). Cabinet 2 with 32 control units is connected by two LLV.V / 16. The optical fiber distribution boxed in cabinet 1 are cascade level one, the left-hand LLV.V / 16 in cabinet 2 level two, the LWL series-connected LLV.V / 16 is level three.

4. ASSEMBLY OF FIBER OPTICS

4.1 IMPORTANT RULES FOR THE ASSEMBLY OF OPTICAL FIBERS

• Keep all optical fiber components clean before installation
• Never buckle or knot optical fibers (minimum bending radius 30mm)
• Do not use hot-shrink sleeves with optical fibers or heat them above 80°C

4.2 CONNECTION OF OPTICAL FIBERS TO THE RS232/LWL CONNECTING PLUG

The following points must be observed to achieve an interference-free and reliable data transfer. Please proceed as follows:

1. Prepare the optical fiber cables according to the following illustration. The PE sheath of the fibers must not be removed.
2. When cutting the ends of the fibers, observe a clean, perpendicular knife stroke. Keep the ends of the fibers clean and do not touch them.

3. Insert the fibers as far as they will go into the inlet of the adapter and screw firstly the securing mechanism, then the cable clamp tight.

4. Observe that the lines (T and R) are crossed in the connection.

5. Connect the LWL transducer to the interface or the DP2 interface board.

4.3 CONNECTION OF OPTICAL FIBER TO THE LWL PLUG

1. Cut the optical waveguide cable to the desired length and prepare the cable according to the following illustration. The optical fibers must not be damaged during handling.

2. Insert the end of the optical waveguide into the crimp ring and the plug. The optical waveguide fiber must protrude approx. 3 mm from the end of the plug. Place the crimp ring flush with end of the plug and secure with crimping pliers.
3. Insert the LWL plug completely into the polishing device. Place 600-gauge abrasive paper on a level surface. Depress the plug and polish the fiber by the figure-eight motion until the plug is flush with the polishing device. Then wipe the plug with a clean rag or a paper handkerchief. Two plugs can be polished simultaneously with the polishing device. The four dots on the abrasive surface of the polishing device indicate the wear. Use a new polishing device when these dots are no longer visible.

4. For final polishing, repeat point 3) for approx. 25 cycles on the dull side of a very fine abrasive paper (3μm lapping film, red).
## 5. ACCESSORIES

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<th>DESCRIPTION</th>
<th>BRIEF DESCRIPTION</th>
<th>E-NUMBER</th>
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