Technical Information

Power supply module
Type LG 2076.00 L

1070 078 238 – 101

P.-No. 4542 / GB1 - 02/97

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Safety instructions

The product described was developed, manufactured and tested in compliance with the fundamental safety requirements of the EU machine directive.

Nevertheless, there still is some residual risk!

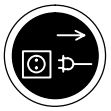
Please read this manual before installing or connecting the product or putting it into operation and store it in a place to which all users have access at any time.

Explanation of pictographs and symbols

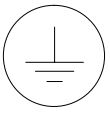
The following warnings and notes may be attached to the **individual hardware components** which are designed to inform the user of certain circumstances.

- Warning of dangerous voltages!

- Components subject to electrostatic induction!



- Disconnect mains plug before opening!



- Bolt for connection of the PE (protective earth) conductor only!

- For shield conductor only!

There is a certain **hierarchy of warnings** in **this manual**. The warnings are printed in **bold letters** and marked by a warning sign at the margin.

The hierarchy of the warnings is as follows:

1. WARNING
2. ATTENTION
3. NOTE

WARNING!

The term **WARNING** will be used wherever **danger is imminent.**
The possible consequences may be death or severe injury (personal injury).

ATTENTION!

The term **ATTENTION** will be used wherever a **dangerous situation is possible.**
The possible consequences include death, severe or light injury (personal injury) damage to property or environmental hazards.

NOTE

The term **NOTE** will be used for making **recommendations on the use.**
Non−compliance with these recommendations may result in damage to property, e.g. to the machine or the workpiece.

Warning of magnetic fields

In the environment of resistance welding systems magnetic field strengths have to be expected which usually are below the limits specified in VDE 0848 Part 4; in cases of doubt, the field strength must be measured.

WARNING for operating personnel!

When using manual welding guns, the limit values may be exceeded for the extremities. In this case, additional work protection measures must be taken.

WARNING for persons with cardiac pacemakers!

Warning signs should be posted for protecting persons with cardiac pacemakers because the function of these devices may be disturbed (impulse failure, total failure) and a negative influence on the pacemaker programming or even a total program destruction may occur !!!

We recommend posting a warning of the type shown below at all entrances to factory halls containing resistance welding equipment:

No entry for persons with cardiac pacemakers!
Danger!

DIN 40023

Normal use

The power supply modules LG 2076.00 L in connection with suitable welding transformers and the PSS.../PSH... timer modules serve for

- **resistance welding of metals.**

The power supply module is used for controlling the welding transformer.

It is not intended for any other use!

ATTENTION!

The use for purposes other than the intended use may result in personal damage to the user or third persons or damage to the equipment, the workpiece to be welded or environmental hazards.
Therefore, our products should only be used for their intended purpose!

Qualified personnel

This manual is designed for welding technicians and engineers with special training and specific knowledge of the welding technology. They require profound knowledge of the hardware components of the timer, the thyristor power supply unit (LG 2076.00 L) and the welding transformer.

The term qualified personnel refers to

- engineering personnel familiar with the safety standards of the electrical and automation technology.
- commissioning personnel entitled to commission, earth and label electrical circuits and equipment/systems in compliance with the standards of safety technology.
- operating personnel who have been instructed in operating installations in resistance welding technology and who know the contents of the present documentation as far as operation is concerned.

WARNING!

An exception are persons with cardiac pacemakers!
Due to the strong magnetic fields arising from resistance welding, the function of cardiac pacemakers may be disturbed. This may cause the death or considerable health damages to the persons concerned!
Therefore, these persons should avoid the welding system.

Please note our comprehensive range of training courses. An overview of courses is given on the inside of the cover of the manual. More information is available from our **training center** (Phone: ++49 (0)6062 / 78258).

Installation and assembly

ATTENTION!

– Danger of life and of damage to property through insufficient protection class!
The protection class of the power supply modules is IP 20. The modules must be installed in a switch cabinet which must at least comply with protection class IP 54 (cf. also "Technical Data" Section).

– Danger of injury and of damage to property through incorrect installation!
The units, and especially the operating elements, must be installed so as to be sufficiently protected against unintentional operation or contact.

– Danger of injury and of damage to property when operating the units outside a switch cabinet!
The units are designed to be installed in housings or switch cabinets and may only be operated in such housings or cabinets with the door closed!

– Danger of injury at sharp metal edges!
You should therefore wear protective gloves.

– Danger of damage to property through short–circuits!
When drilling or sawing out openings within switch cabinets, metal burr may get inside modules that have already been installed. It is also possible that water may emerge during the installation of the cooling water lines and may enter the modules.
The possibility of short–circuits and a destruction of the units cannot be entirely ruled out.
Therefore, the modules should be well partitioned prior to any additional work!
No liability is accepted in the event of non–compliance.

– Damages to property through leaks in the cooling water circuit!
A leak in the cooling water circuit may cause damages to adjacent components through emerging cooling water. Therefore you should install water–cooled modules so as to sufficiently protect other units in the switch cabinet against leaking cooling water.

NOTE

– Connecting lines and signal lines must be laid so as to avoid negative effects on the function of the units through capacitive or inductive interference!

– A clearance of min. 100 mm must be available above and below the power supply modules modules. Lower clearances induce the danger of heat accumulations which may result in a failure of the unit.

Electrical connection

The power supply modules are connected to the supplying mains.

WARNING!

– The mains voltage is associated with many dangers!
The possible consequences of inappropriate handling include death or most severe injuries (personal injuries) and damage to property.
For this reason, the electrical connection must always be made by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.
The mains voltage must be identical with the nominal voltage given on the nameplate of the product!
The equipment must be appropriately fused at the mains side!

– Danger of life through electrical voltage!
The power supply modules must be connected to the protective earthing (PE) circuit of the system. Please ensure that a sufficient conductor cross–section is used for wiring the protective conductor. The electrical continuity of the protective earthing circuit must be verified in accordance with EN 60204 Part 1.

Operation of the power supply modules

ATTENTION!

– Danger of injury and of damage to property when operating the units outside a switch cabinet!
The units are designed to be installed in housings or switch cabinets and may only be operated in such housings or cabinets with the door closed!

– Danger of injury and of damage to property through missing or false interpretation of fault messages!
Therefore, closing of the temperature contact connected to X6 (thermostatic switch, ncc) of the modules must inhibit the connected timer! For interpreting the fault messages also note the information contained in the ”Fault messages” Section.

– Danger of bruises through electrode movement!
All users, line designers, welding machine manufacturers and welding gun producers are obliged to connect the output signal of the Bosch weld timer which initiates the electrode movement so that the applicable safety regulations are complied with.
The risk of bruises can be considerably reduced by means of,
e.g.,
- two−handed start
- guard rails
- light barriers etc.

NOTE

– Damage to property through insufficient cooling of the modules!
Please ensure sufficient cooling of the modules during operation (air supply max. 45 °C).

– Damage to property through excessive welding current!
The maximum admissible welding current depends on the thyristors of the power supply modules and must not be exceeded.
Therefore, the thyristor load must be verified in each individual case by the user. For more information, please refer to the ”Dimensioning instructions” Section.
No liability is accepted in the event of non−compliance.

Retrofits and modifications by the user

The power supply units have been designed and manufactured by us as safe units.

WARNING!

Modifications may have negative effects on the safety of the unit! The possible consequences include death, severe or light injury (personal injury), damage to property and environmental hazards.
Therefore, please contact us prior to modifications. This is the only way to determine whether modified parts are suitable for use with our product.

Maintenance, repair

WARNING!

– Danger of life through electrical voltage!
Prior to any maintenance work – unless described otherwise – the system must always be switched off! In the event of necessary measurement or test procedures on the active system, the applicable safety and accident prevention regulations must be strictly observed. In any case, suitable insulated tools must be used!

– Danger of life through inappropriate EMERGENCY–OFF facilities!
EMERGENCY–OFF facilities must be operative in all modes of the system. Releasing the EMERGENCY–OFF facility must by no means result in an uncontrolled restart of the system!

ATTENTION!

–The right to perform repair/maintenance work on the timer compenents is reserved to the BOSCH service department or to repair/maintenance units authorized by BOSCH!

– Only use spare parts/replacement parts approved by BOSCH!

– Spent batteries or accumulators must be disposed of as hazardous waste.

Working safely

WARNING!

– During operation of the welding equipment welding splashes are to be expected! The consequence may be injuries to the eyes or burns. Therefore:
  ◔ wear protective goggles
  ◔ wear protective gloves
  ◔ wear flame–retardant clothes

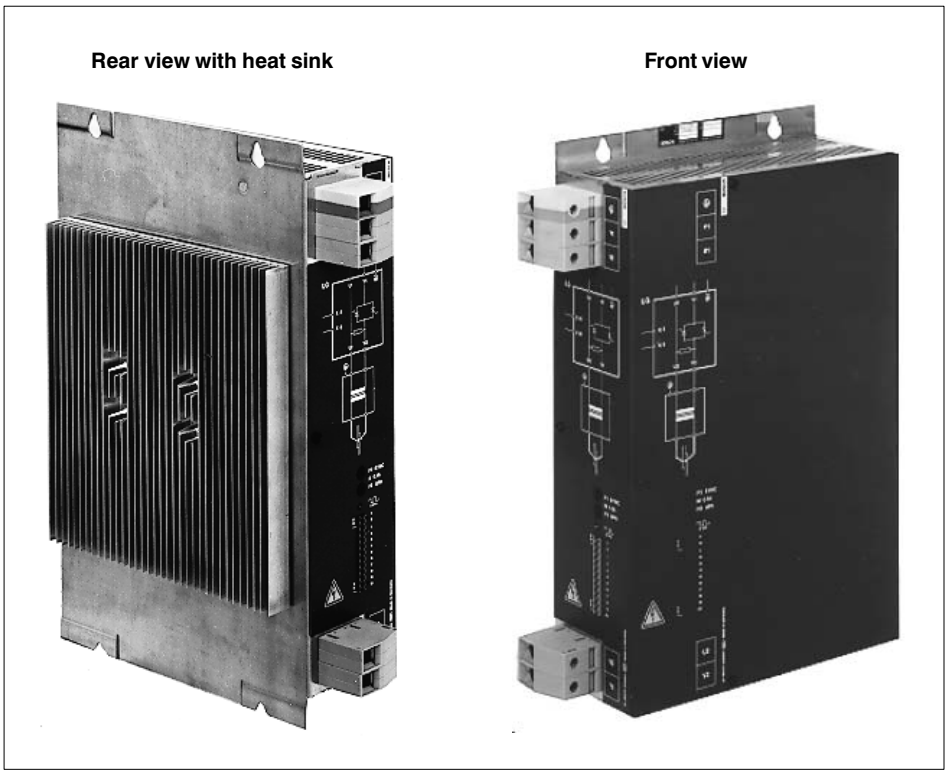
– Danger of injury at sheet metal edges and danger of getting burnt at the parts to be welded!
Therefore: ◔ wear protective gloves

NOTE

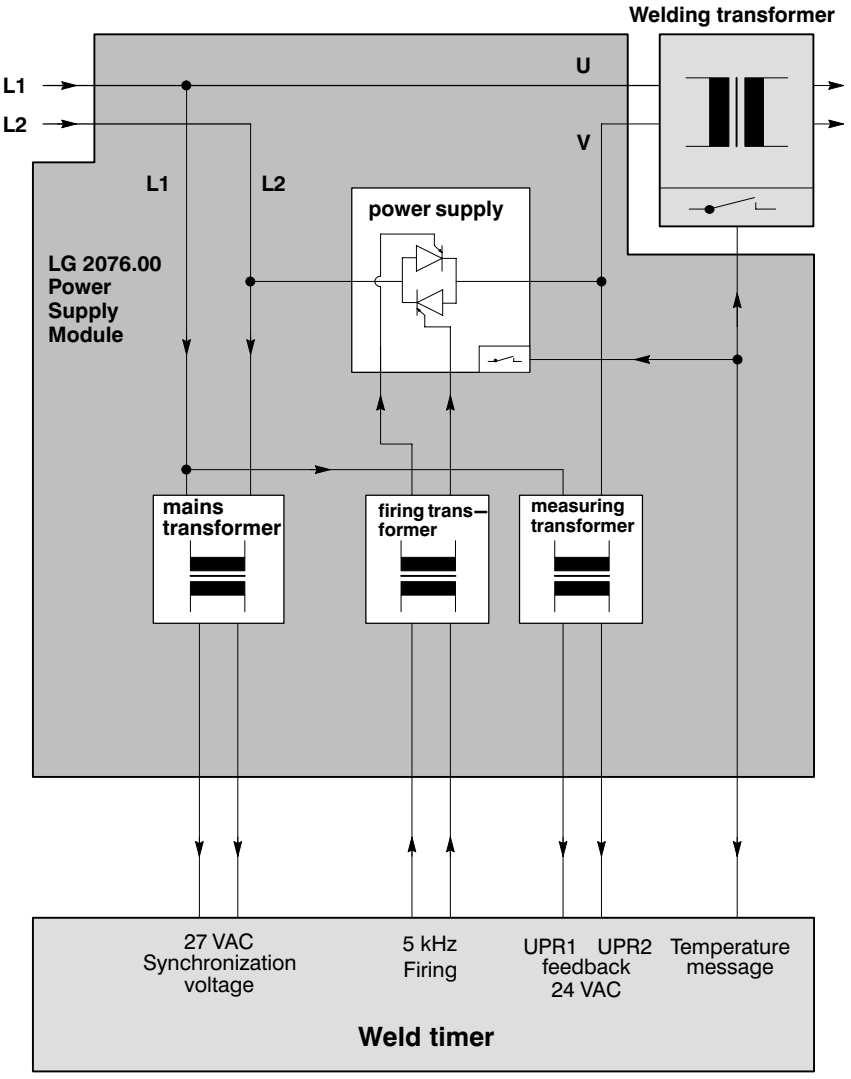
– The strong magnetic fields arising in connection with resistance welding may cause lasting damages to wrist watches, pocket watches, or cards with magnetic stripes (e.g. EC cards).
Therefore, you should not carry any such items on you when working in the direct vicinity of the welding equipment.

1. Structure

The LG 2076.00 L power supply module serves to operate a welding transformer with max. 76 kVA.



It contains the firing component as well as the thyristor power supply for triggering the welding transformer.
The firing component is triggered by the weld timer. It transmits firing pulses to the thyristor power supply.
The integrated power supply generates the 27 VAC supply voltage for the weld timer (synchronization voltage).
The primary voltage of the welding transformer is measured and transmitted to the weld timer for evaluation and control.
If the welding transformer or the thyristor power supply is overloaded, a thermostatic switch is released, thus stopping the weld timer which will output a fault message.



Block diagram: LG 2076.00 L Power Supply Module

2. Technical data

Type of construction:	2−phase thyristor AC power controller as built−in module; optimized for use in the ”Schweisskoffer”
Protection standard:	IP 20; designed for installation in housing or switch cabinet with IP54
Ambient temperature:	max. 45 ˚C (heat sink environment); 60 ˚C referred to the room of the installation
Storage temperature:	−25 ˚C to +70 ˚C
Mains voltage connection:	380 V to 600 V 50−60 Hz
Admissible voltage variations:	+15%, −20%
Synchronization voltage:	for PSS 5000: 27 VAC (with 400V mains voltage) (fused with M 0.1A at SYNC/F1)
Percentage duty cycle (ED):	max. admissible ED: 50% (independent from the possible thyristor switching currents, limited by built−in 2.2 kΩ de−excitation resistor)
Connected load:	for welding transformers up to approx. 76 kVA (with 400 V). Max. admissible switching currents depend on the duty cycle and the weld time, see load diagram in ”Dimensioning instructions” Section.
Thyristor voltage:	1600 V
Thyristor switching current:	refer to load diagram
Rated current:	130 A (e.g. 76 kVA/400V) Must be considered for mains and transformer feeder rating
Overvoltage protection:	by MOV (metal−oxide varistor)

Electrical connection:	Mains connection L1 (auxiliary phase): terminal U1 (HDFK 50 mm^2) Mains connection L2: Terminal V1 (HDFK 50 mm^2) Welding transformer connection U: Terminal U2 (HDFK 50 mm^2) Welding transformer connection V: Terminal V2 (HDFK 50mm^2) PE connection: Terminal ⏚ (HDFK 50mm^2)
Connection to timer unit:	via 10−pin (X5) and 2−pin (X6) plug−in terminals MSTB with cable (approx. 400 mm long)
Cooling:	Convection, air supply max. 45 °C Cooling is monitored by thermostatic switch
Fault messages:	Thermostatic switch signal, floating relay contact (ncc); it is evaluated by the timer which outputs the fault message: ”Overtemperature − power supply fault”
Monitoring:	Feedback transformer, transformer ratio: 16.7 : 1. Primary voltage of the welding transformer is reduced to 24 VAC (with 400V mains voltage); fused with M 0.1A at UPR/F2)
Display:	Incoming firing pulses are indicated by yellow LED ”5 kHz firing”

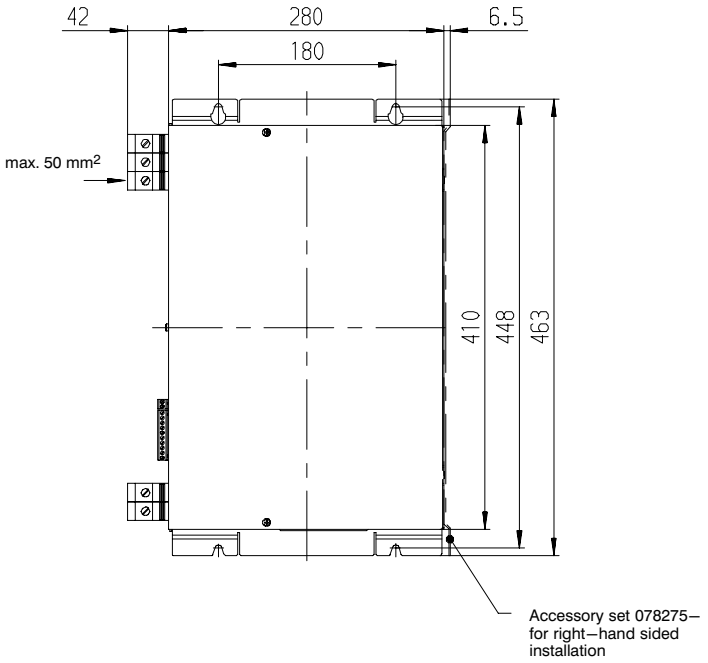
3. Technical data

Type of construction:	2−phase thyristor AC power controller as built−in module; optimized for use in the ”Schweisskoffer”
Protection standard:	IP 20; designed for installation in housing or switch cabinet with IP54
Ambient temperature:	max. 45 ˚C (heat sink environment); 60 ˚C referred to the room of the installation
Storage temperature:	−25 ˚C to +70 ˚C
Mains voltage connection:	380 V to 600 V 50−60 Hz
Admissible voltage variations:	+15%, −20%
Synchronization voltage:	for PSS 5000: 27 VAC (with 400V mains voltage) (fused with M 0.1A at SYNC/F1)
Percentage duty cycle (ED):	max. admissible ED: 50% (independent from the possible thyristor switching currents, limited by built−in 2.2 kΩ de−excitation resistor)
Connected load:	for welding transformers up to approx. 150 kVA (with 400 V). Max. admissible switching currents depend on the duty cycle and the weld time, see load diagram in ”Dimensioning instructions” Section.
Thyristor voltage:	1600 V
Thyristor switching current:	refer to load diagram
Rated current:	200 A (e.g. 76 kVA/400V) Must be considered for mains and transformer feeder rating
Overvoltage protection:	by MOV (metal−oxide varistor)

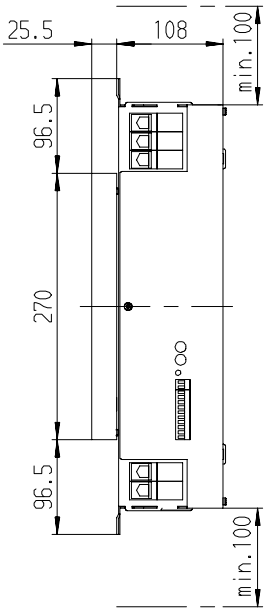
Electrical connection:	Mains connection L1 (auxiliary phase): terminal U1 (HDFK 95 mm^2) Mains connection L2: Terminal V1 (HDFK 95 mm^2) Welding transformer connection U: Terminal U2 (HDFK 95 mm^2) Welding transformer connection V: Terminal V2 (HDFK 95mm^2) PE connection: Terminal ⏚ (HDFK 95mm^2)
Connection to timer unit:	via 10−pin (X5) and 2−pin (X6) plug−in terminals
Cooling:	Convection, air supply max. 45 °C Cooling is monitored by thermostatic switch
Fault messages:	Thermostatic switch signal, floating contact (ncc); it is evaluated by the timer which outputs the fault message: "Overtemperature − power supply fault"
Monitoring:	Feedback transformer, transformer ratio: 16.7 : 1. Primary voltage of the welding transformer is reduced to 24 VAC (with 400V mains voltage); fused with M 0.1A at UPR/F2)
Display:	Incoming firing pulses are indicated by yellow LED "5 kHz firing"

4. Dimensions

Front view

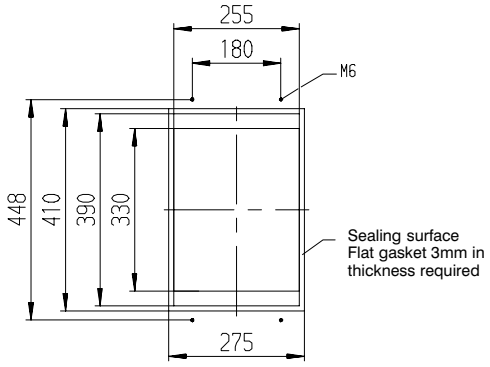


Left side view (seen from front side)

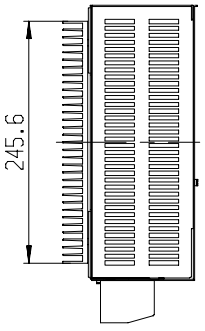


100mm installation clearance above and below the power supply module!

Recommended installation knock–out



View from above



5. Installation instructions

WARNING!

– Danger of life through mains voltage!
Therefore, the space designed for installation must be disconnected from the supply and sufficiently protected against accidental or unauthorized reclosing prior to installation.

ATTENTION!

– Danger of life and of damage to property through insufficient protection class!
The protection class of the power supply modules is IP 20. The modules must be installed in a switch cabinet which must at least comply with protection class IP 54 (cf. also ”Technical Data” Section).
– Danger of injury and of damage to property through incorrect installation!
The units, and especially the operating elements, must be installed so as to be sufficiently protected against unintentional operation or contact.
– Danger of injury and of damage to property when operating the units outside a switch cabinet!
The units are designed to be installed in housings or switch cabinets and may only be operated in such housings or cabinets with the door closed!
– Danger of injury at sharp metal edges!
You should therefore wear protective gloves.

NOTE

– Danger of damage to property through short–circuits!
When drilling or sawing out openings within switch cabinets, metal burr may get inside modules that have already been installed. It is also possible that water may emerge during the installation of the cooling water lines and may enter the modules.
The possibility of short–circuits and a destruction of the units cannot be entirely ruled out.
Therefore, the modules should be well partitioned prior to any additional work!
No liability is accepted in the event of non–compliance.
– Damages to property through leaks in the cooling water circuit!
A leak in the cooling water circuit may cause damages to adjacent components through emerging cooling water. Therefore you should install water–cooled modules so as to sufficiently protect other units in the switch cabinet against leaking cooling water.
– Functional disturbances through capacitive or inductive interference!
Connecting lines and signal lines must be laid so as to avoid negative effects on the function of the units through capacitive or inductive interference!
– Equipment failure through accumulation of heat!
Therefore, a clearance of min. 100 mm must be available above and below the power supply modules. Please ensure that the air circulation is not obstructed at the rear heat sink.

The power supply module is most appropriately attached to the wall of the housing/switch cabinet (fastening: M6 bolts). For the dimensions of the fastening holes, please refer to the dimensioned drawings in the ”Dimensions” Section. The unit should be installed vertically.

During installation it must be ensured that the contact surfaces are bare, i.e. free from paint, plastic coating or contamination/oxidation.

6. Connection instructions

6.1. Mains and welding transformer connection

WARNING!

– The mains voltage is associated with many dangers!
The possible consequences of inappropriate handling include death or most severe injuries (personal injuries) and damage to property.
For this reason, the electrical connection must always be made by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.
The following must be noted before making the connection:
  – mains OFF
  – protection against reclosing
  – verify safe isolation from supply
  – earthing and short–circuiting
  – cover or barrier adjacent live parts

– Danger of life through electrical voltage!
The power supply modules must be connected to the protective earthing (PE) circuit of the system. Please ensure that a sufficient conductor cross–section is used for wiring the protective conductor. The electrical continuity of the protective earthing circuit must be verified in accordance with EN 60204 Part 1.

ATTENTION!

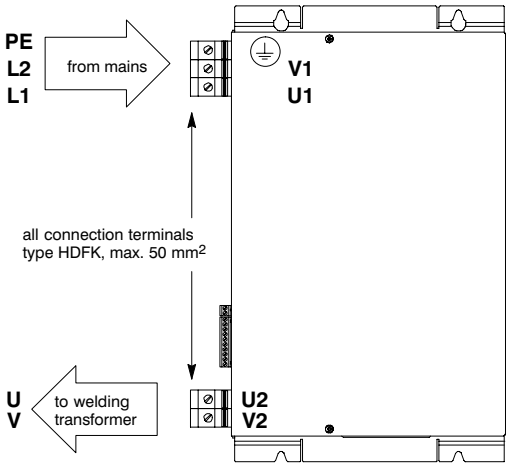
– Possibility of dangerous situations at the system and failure of the electrical assemblies due to incorrect mains voltage!
Therefore, the following should be noted:
The mains voltage must be within the specified voltage rating.
Variations or deviations of the mains voltage from its nominal value must not exceed or fall below the specified tolerances (refer to ”Technical data” Section).
Appropriate electrical fusing equipment must be available on the mains side!

– **PE connection:** must be connected to a centralized earthable point. Note sufficient cable cross–section!
– All conductor cross–sections must be rated in accordance with the connected load.
– **Connection U1:** (auxiliary phase): connect to mains phase L1.
– **Connection V1:** connect to mains phase L2.
– **Outgoing welding transformer feeders U2 and V2:** connect to welding transformer (U, V).

NOTE

Danger of damage to property through working loose of connecting cables! Therefore, cables must be firmly terminated.

Front view

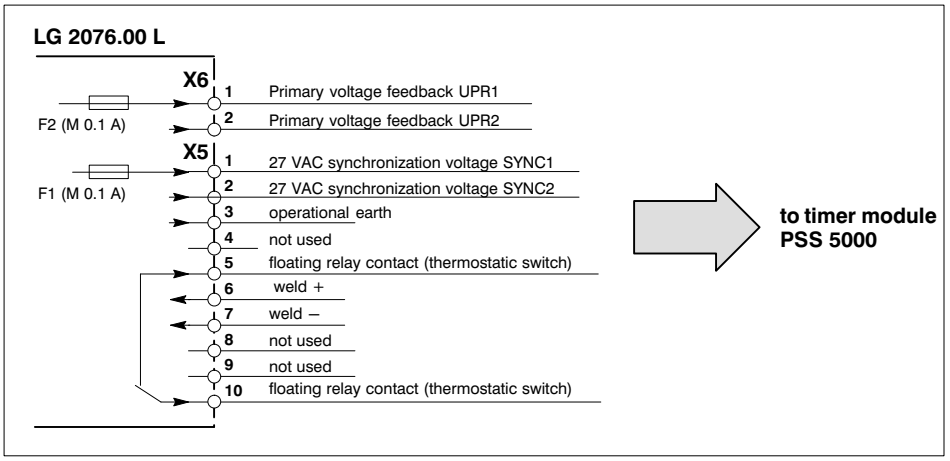


6.2. Connection to the timer module

The power supply module is connected to the timer module (UPR and PSL connectors) via connectors X5 and X6 using unshielded cables. The MSTB plug–in terminals for X5 and X6 are included in the delivery.

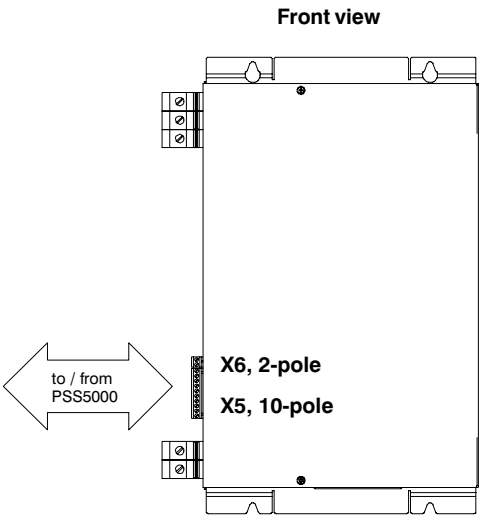
Max. clampable wire cross–section: 1.5 mm^2

Required conductor cross–sections: up to 10 m: min. 0.75 mm^2
10 m up to 75 m: 1.5 mm^2



ATTENTION!

– The connections X5 and X6 may only be made or removed when the unit is safely isolated from supply!



7. Maintenance

The power supply module is maintenance–free. However, a faulty connection or inadmissibly high mains overvoltages can cause an activation of the protective fuses in the device.
The protective fuses may be replaced by the user.
Any other defects should be remedied by the manufacturer.

WARNING!

– Danger of life through electrical voltage!
Disconnect the power supply module from the mains before locating faults or replacing fuses!

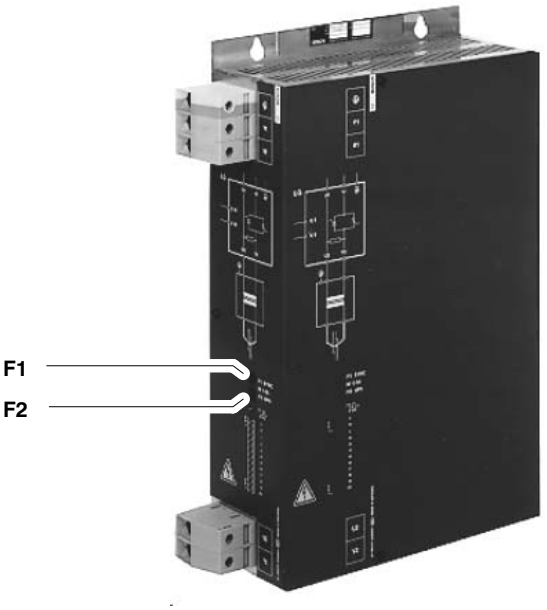
ATTENTION!

– Danger of personal injury or damage to property!
Only use the fuse types and ratings specified. Fuses must not be bridged!

The following fuses may be used:

At the **left–hand side** of the unit:

F1	SYNC:	M 0.1 A (G5 x 20mm)	27 VAC synchronization voltage
F2	UPR:	M 0.1 A (G5 x 20mm)	24 VAC Measuring transformer output voltage



8. Dimensioning instructions

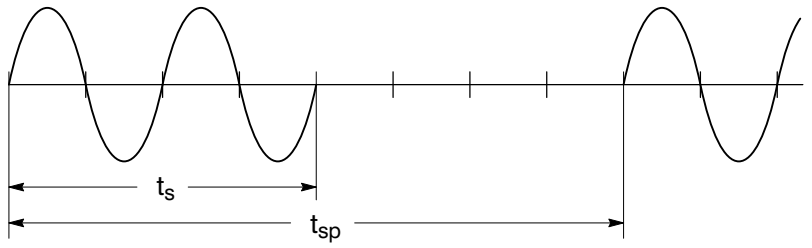
The thyristor load is defined by the allocation of the thyristor types to certain maximum welding transformer sizes.

NOTE

– Possible damage to the power supply module!
Therefore, check the actual load of the thyristor in each individual case!
No liability is accepted in the event of damages caused by overload.

For this purpose, the load diagram is used. This load diagram indicates
the effective currents (I_{RMS} in A) which the thyristor is capable of switching as a function of
the duty cycle (ED in %) at max.
air temperature (in ˚C)

For determining the percentage duty cycle (ED), the weld time t_s and the weld cycle time t_{sp} must be known.



Weld time and weld cycle time

The duty cycle (ED) is calculated as follows:

$$ED = \frac{t_s}{t_{sp}} * 100\%$$

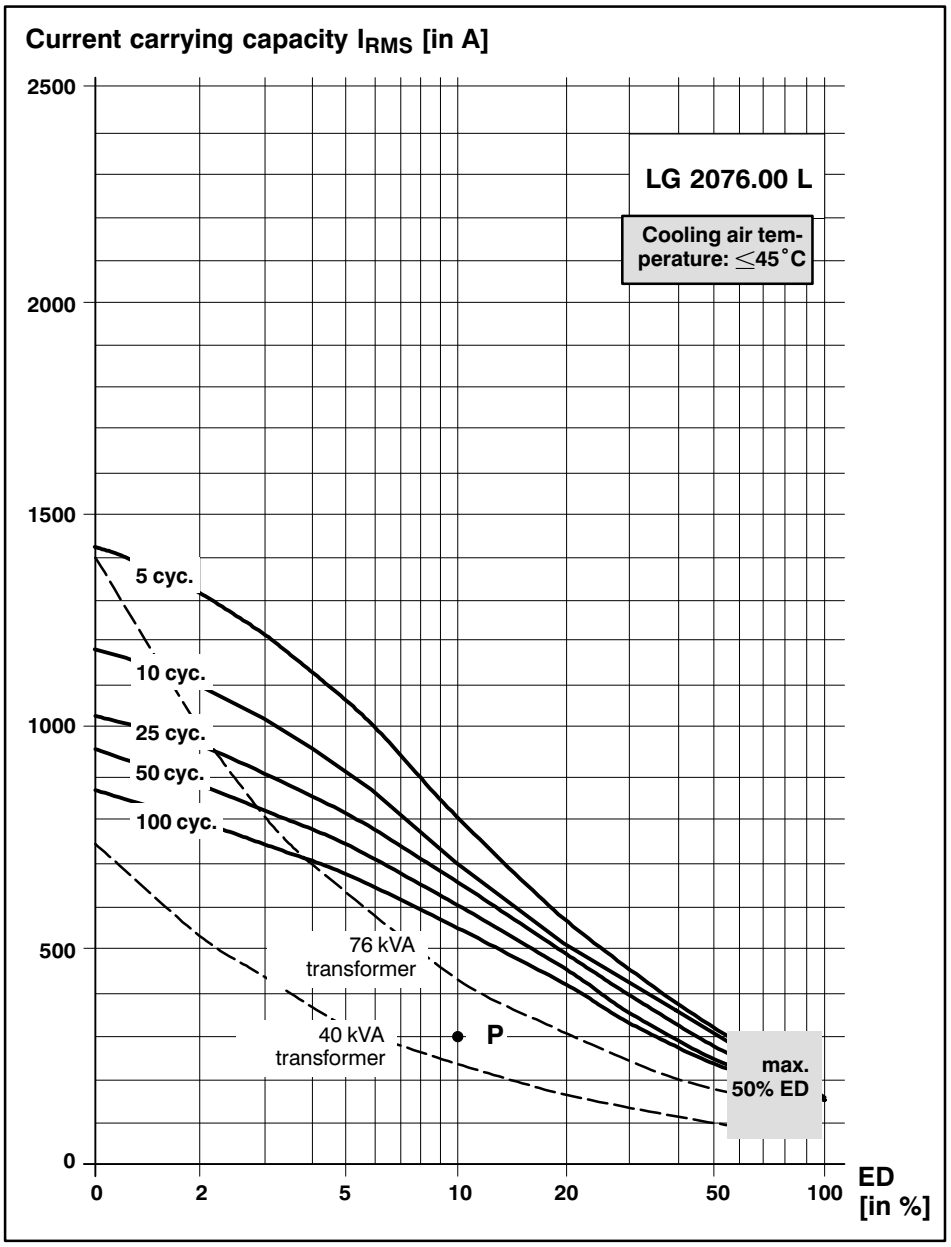
Example: In the figure above, the weld time is 2 cycles and the weld cycle time is 4 cycles.
This results in a duty cycle of ED=50%.

$$ED = \frac{2 \text{ cycles}}{4 \text{ cycles}} * 100\% = 50\%$$

NOTE

– If there are different weld times and cycle times at one machine, the longest weld time and the shortest cycle time (if necessary, by adding the longest weld time and the shortest pause time) are to be used for calculating the ED!

When the duty cycle has been calculated, the following load diagram can be used to verify the correct dimensioning of the thyristors:



Example: Weld data of the machine: 76 kVA
Weld time: t_s = 10 cycles
Duty cycle: ED = 10%
Current: I_{RMS} = 300 A
The intersection (P) for ED = 10% and I_{RMS} = 300 A found in the diagram is **below** the curve for weld times up to 10 cycles.
Thus, the thyristor has been properly dimensioned.

9. Fault messages

The following precautions were taken for protecting the thyristor block:

– **Temperature monitoring**
A bimetallic switch is located at the thyristor block which opens the internal connection between pins 5 and 10 of terminal X5 when temperatures $\geq$ 56 °C (±5 °C) are reached and transmits this message to the timer. As a consequence, the timer is inhibited. The ready signal at the timer goes off and the fault message "Overtemperature – power supply fault" will be output.

Possible causes	Elimination
– Heat sink contaminated:	Clean heat sink.
– Thyristor rating too small:	Calculate % duty cycle, check thyristor dimensioning on the basis of the load diagram (cf. "Dimensioning instructions" Section).

10. Index

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