PSI 6XXX.190 W1
Technical Information

Edition
101

PSI 6000 Description of Timer and I/O Level

PSI 6XXX.190 W1
Technical Information

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Discretionary charge DM 20.--

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Your notes:

Safety instructions and reader's information

Please read this documentation before working with the **W**eld **T**imer (WT) PSI 6XXX.190 W1 for the first time.

Store this manual in a place to which all users have access at all times!

The products described have been developed, manufactured, tested and documented in compliance with the fundamental safety requirements of the EU Machinery Directive.

Nevertheless, there is some residual risk!

The present manual describes the following functions:

- timer module PSI 6XXX.190 W1

- I/O level

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 electrical voltage!

Components sensitive to electrostatic discharge!

Disconnect from mains before opening!

Pin for connecting PE conductor only!

Connection of 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. CAUTION
3. NOTE

WARNING!

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

CAUTION!

The term **CAUTION** will be used wherever a **dangerous situation is possible.**
The possible consequences include death, severe or light injury (personal injury) damage to property (destruction of modules) or environmental hazards.
In any case, the failure to observe/comply with these instructions will result in the loss of guaranty.

NOTE

*The term **NOTE** will be used for making **recommendations on the use.** These sections contain additional information, recommendations, hints and tips.*
Non-compliance with these recommendations may result in damage to property, e.g. to the machine or the workpiece.

Typographic conventions

General listing	-	Example:	-	The message is displayed on the screen.
Action	●	Example:	●	Insert floppy
			●	Read value
Screen displays, messages, displays	*Italics*	Example:		*Battery-Low*
				Tip dress request
(Welding) parameters	[in brackets]	Example:		[Weld time], [Schedule].
Interface signals, keys, command fields.	**\<key\>**	Example:		Press **\<F8\>**
Inputs: Values, texts	CAPITAL LETTERS			

> **NOTE**
>
> *Note concerning this manual: Black bars in the margin of a page indicate modifications compared to the previous edition.*

Proper use

The present manual contains information on the proper use of the weld timer type PSI 6XXX.190 W1.

In connection with the intended power supply and the specified welding equipment, the weld timer type PSI 6XXX.190 W1

- **serves for resistance welding of metals**

- **is suitable for operation in industrial environments in accordance with DIN EN 50082-2 and DIN EN 50081-2 concerning electromagnetic compatibility (EMC).**

The timer is not intended for any other use!

> **CAUTION!**
>
> 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!

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.

Dangers, if any, may arise from alternating magnetic fields (critical frequency: 1.6 Hz).

⚠ **WARNING!**

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

So far, no problems have been reported. Nevertheless, the possible influences are lower with medium-frequency welding than with AC welding.

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.

Not permitted for persons with cardiac pacemakers

⚠️ **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

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

- weld timers (WT)

- MF inverters (PSI)

- welding transformers and/or welding rectifier-transformers (PSG)

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. More information is available from our **training center** (Phone: +49 (0)6062 / 78258).

Storage and Transport

> **NOTE**
>
> *Please note the environmental conditions given in the Technical data section to avoid damages.*
> *Static discharges may destroy components of the weld timer. Therefore, the original packaging should be used for storage and transport. The equipment must be protected against humidity.*

> **NOTE**
>
> *CDs and floppies must be protected against negative external influences of dust or moisture by suitable packaging. They must never be exposed to the influence of magnetic fields.*

Installation and assembly

CAUTION!

- Please observe all applicable safety and accident prevention regulations! The recognized rules of electrical engineering must be observed!

- Danger of injury or of damage to property due to inappropriate fastening!
  The place of installation and the fastening method for the modules must be in compliance with our specifications!

- Danger of injury on sharp metal edges!
  Please 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.

- Danger of life and of damage to property through insufficient protection type!
  The protection type of the PSI 6XXX.190 W1 modules is IP 00. The modules shall be installed together with a power supply as a single unit in a housing with a sufficient degree of protection (at least IP54).

- Danger of injury and of damage to property through incorrect installation!
  The weld timer, 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 damages through static discharge!
  Elements or components of the weld timer may be damaged by static discharge. Do not touch any components or printed circuits with your hands. Installing and configuring the system is reserved to qualified personnel.

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 and in compliance with the requirements on electromagnetic compatibility (EMC), cf. also section 7 as well as general information contained in the Bosch EMC manual for resistance welding components.

Electrical connection

The PSI 6XXX.190 W1 are supplied with 24 V DC. This power supply must provide safety separation in accordance with the Low-Voltage Directive (72/23/EEC, 93/68/EEC and 93/44/EEC).

> **WARNING!**
>
> - Considerable dangers are associated with the mains connection of the power unit!
>
> - The possible consequences of inappropriate handling include death, severe bodily injury and damage to property.
>
> - Therefore, the electrical connection may only be made by a skilled electrician who observes the valid safety regulations, the mains voltage and the maximum current consumption of the modules.
>
> - The mains voltage must be identical with the nominal voltage indicated on the nameplate of the product!
>
> - The mains system must be appropriately fused!
>
> - Danger of life through electrical voltage!
>
> - Suitable protective measures in accordance with DIN EN 50063 or DIN VDE 0545, Part 1 must be installed (e.g. by grounding the welding gun) on the welding hardware!

Operation

⚠

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

⚠

CAUTION!

-    Danger of injury and of damage to property when operating the units outside a switch cabinet or for purposes other than the intended use!
     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. The recognized rules of electrical engineering must be observed.

-    Danger of injury and of damage to property through missing or false interpretation of fault messages!

-    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 accidents can be considerably reduced by means of, e.g.,
     -    two-handed start
     -    fences
     -    light barriers etc.

-    Systems without **<Monitor contact>** MC
     (not available in all weld timers)
     If **<Monitor contact>** MC is connected to +24 VDC, the [squeeze times] must be selected long enough to permit optimal contact of the part to be welded prior to the [weld time]. If the [squeeze times] are too short, the electrodes close during [weld time]. This will cause strong welding splashes, resulting in damages to the electrodes and the part to be welded!

- Simulate start
  In remote-controlled systems, program execution may begin which may result in dangerous machine movements. Therefore, before remote starting, it must be ensured that nobody is in the dangerous area of the welding machine!

⚠ **CAUTION!**

Damage to property through excessive welding current!
The maximum welding current of the welding hardware used must not be exceeded. No liability is accepted in the event of non-compliance.

Retrofits and modifications by the user

The PSI 6XXX.190 W1 has been designed and manufactured by us as a safe unit.

⚠ **WARNING!**

Retrofits or modifications may have negative effects on the safety of the unit!
The possible consequences include death, severe or light bodily injury (personal injury), damage to property or environmental hazards.
Therefore, please contact us prior to retrofits or modifications to the PSI 6XXX.190 W1 using third-party equipment. This is the only way to determine whether these parts are suitable for use with our product.

Maintenance and repair

WARNING!

- Danger of life through electrical voltage of power units!
  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-STOP facilities!
  EMERGENCY-STOP facilities must be operative in all modes of the system. Releasing the EMERGENCY-STOP facility must by no means result in an uncontrolled restart of the system!

- Danger of explosion of batteries!
  Do not forcefully open batteries, do not attempt to charge, solder or incinerate the battery.
  Empty batteries should always be replaced by new ones!

CAUTION!

- The right to perform repair/maintenance work on the PSI 6XXX.190 W1 components is reserved to the Bosch service department or to repair/maintenance units authorized by Bosch!

- Only use spare parts/replacement parts approved by Bosch!

- The applicable regulations on the disposal of empty batteries or accumulators must be observed.

Your notes:

1   System

1.1   General

Welding **T**imers (WT) of the PSI 6XXX.190 W1 series are specifically designed for seam welds.

The welding system consists of

- Welding hardware (welding gun with seam welding device)
- Timer module PSI 6XXX.190 W1
- MF inverter PSI
- A programming terminal with BOS-5000 software for data entry, operation and monitoring
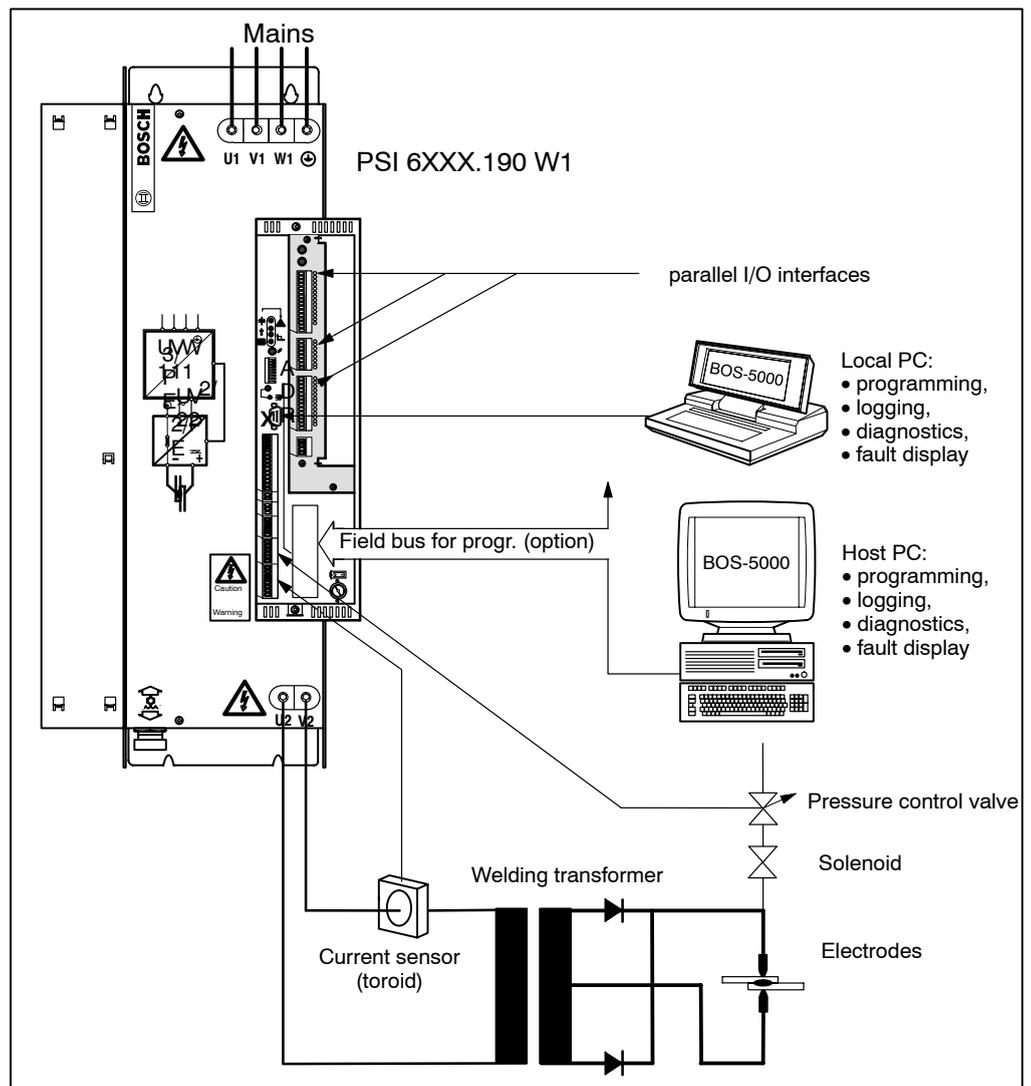
Figure 1: Welding system

Up to 32 seam welding programs can be programmed and called up. In the *basic setup* seam operation is preselected.
The welding parameters are stored in a RAM memory. The RAM memory has battery backup to prevent loss of data. The condition of the battery and the data is being monitored.

The PSI 6XXX.190 W1 is an open system timer. You can select control functions from a variety of selections by entering or modifying the *basic setup* and the *welding parameters*.

You can configure your control by selecting various *basic setups* and *Programming* the *welding parameters*.

This means that you:

-       have to set up parameters for a control type only once

-       can transfer the parameter settings to all your controls.

Functional principle
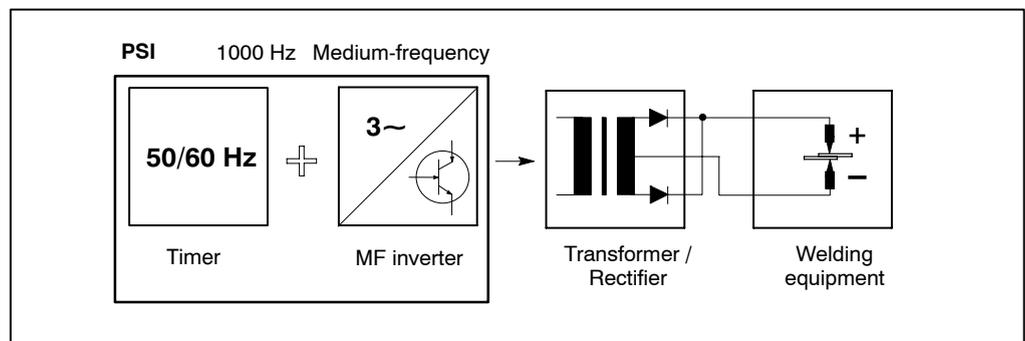
Figure 2: Block diagram of functional principle

Welding current

The Bosch medium-frequency welding system uses DC current for welding. The duration of the welding current is programmed in milliseconds (ms). The welding process is performed more evenly than with 50 Hz welds. The range of good welds is increased.

The medium-frequency welding current is clocked at 1000 Hz. The constant-current regulation system is faster and more precise compared to 50 Hz welding.
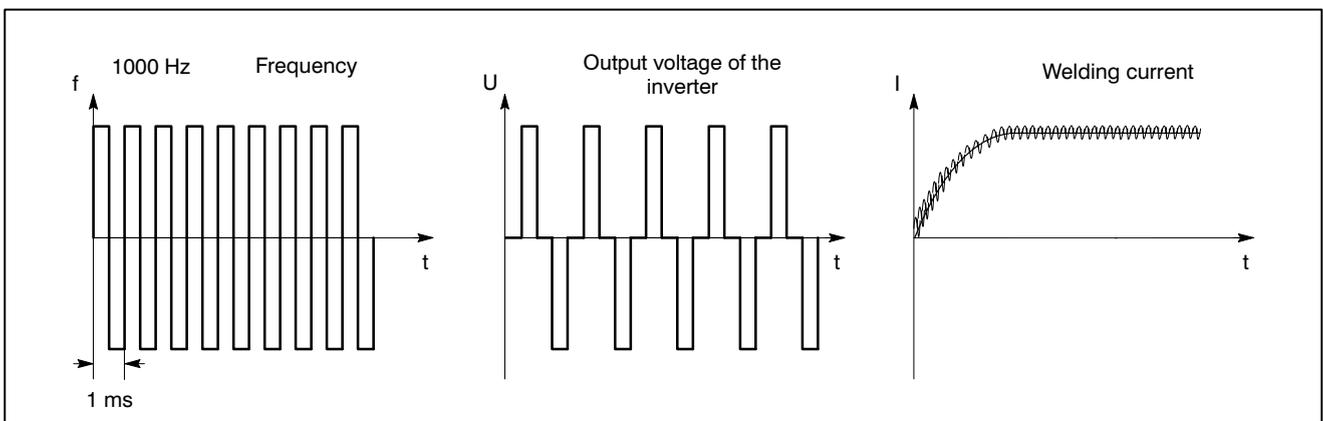
Figure 3: 1000 Hz welding

1.2   Block diagram of timer

On the front panel of the timer is a V24 interface. This can be used for connecting a laptop computer or an operating terminal (BT), for example, for programming as well as operating the timer locally.
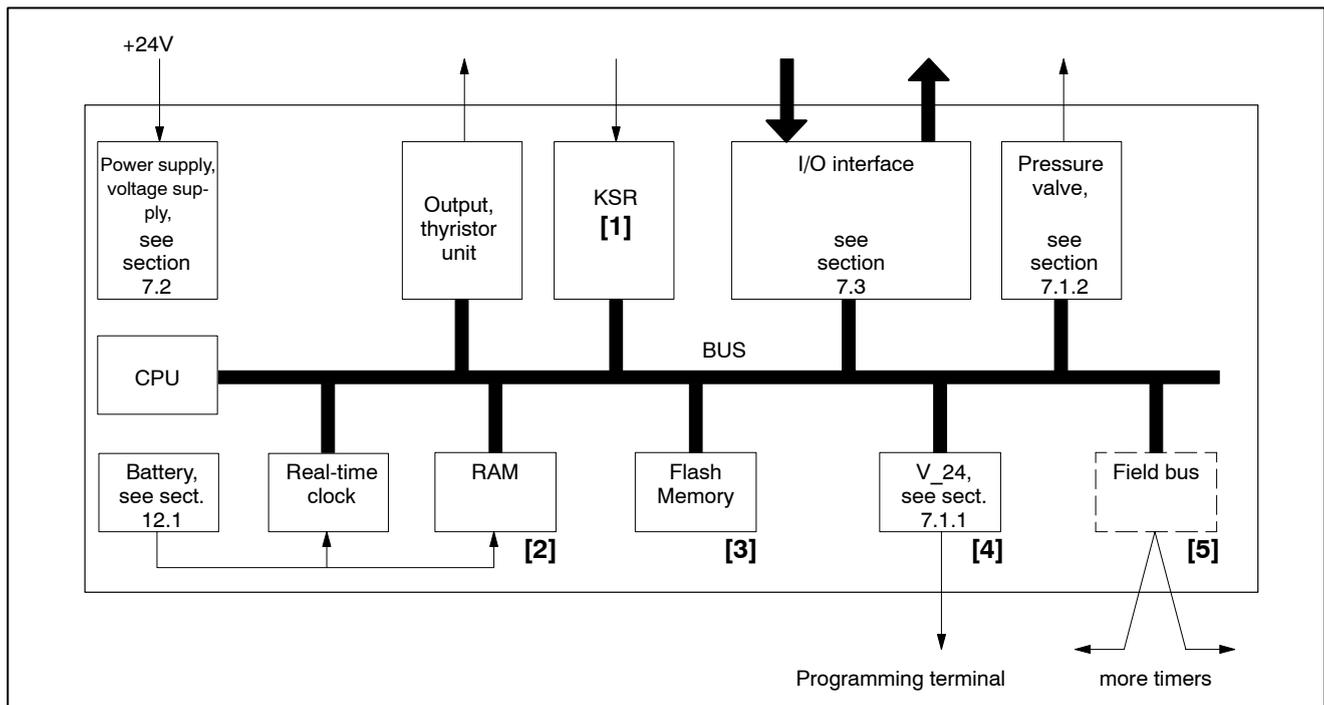
Figure 4: Block diagram of timer

     [1]   Constant current regulation

     [2]   RAM for storing the welding parameters

     [3]   Flash Memory for storing the operating system

     [4]   V24 interface, for connecting a PC or a BT operating terminal on location for programming and monitoring. The operating system can be loaded from this interface.

     [5]   Field bus interface (option)

1-5

1.3   Programming and operating the timer

The following components are required for *Operation* and *Programming* of the timer:

- Programming terminal with one of the following operating systems:
    - Windows 3.1x
    - Windows 95
    - Windows 98
    - Windows NT3.x / NT4.0

- Software BOS-5000

- Technical documentation:
    - Operating and programming instructions, volume 1, part no. 1070 078 217
    - Operating and programming instructions, volume 2, part no. 1070 078 218

- V24 interface cable, see section 7.1.1, suitable installation for field bus interfaces.

Your notes:

2-1

2 Technical data

2.1 Welding timers

Degree of protection	IP20 when installed in power unit
Operating voltage	+24 VDC +20 %, -15 % with max. ±5% ripple optional internal supply or external supply to logic and I/Os
Rated current (w/o I/Os) at 24V	approx. 250mA w/o fieldbus module approx. 350mA with fieldbus module
Starting current	approx. 0.5 to 1.0 A
Power losses	approx. 8.5 VA + 2.4 VA per active input
Environmental conditions - Operation - Storage - Transport - Air pressure - Humidity	0 °C to +55 °C -25 °C . . . . to +70 °C -25 °C . . . . to +70 °C 0 to 2000 m above sea level No dew point excursion allowed
Number of programs	32, access to each program individually from program selection, each program with a maximum of 7 current blocks
Parallel inputs	E0 to E8 : +24 VDC/20 mA, E9 to E13 : w/o function E14 to E16 : +24 VDC/20 mA logic 1 : +16 VDC to +30 VDC logic 0 : -1 VDC to + 4 VDC
Pressure input	+24 VDC/20 mA
Transformer temperature input	floating contact

Parallel outputs	A0 : +24 VDC/1 A max. A1 to A6 : +24 VDC /0.1 A max. A7 to A12 : w/o function
Miniature fuse 5 x 20 parallel outputs	A0 : 1.6 A A1 to A6 : 1.6 A
Pressure output	analog pressure output 0 to + 10 VDC/max. 20 mA
Programming via laptop computer or Bosch BT operating terminal	via internal V24 / RS232 interface, isolated Connection: 9-pin Cannon connector
Field bus for programming (option)	Profibus-FMS or Interbus-PMS
Operating system	in Flash-Memory, can be loaded through V24 / RS232 or field bus
Program memory	RAM memory (battery-buffered)
Backup battery	Lithium battery Typ AA/S to buffer RAM data and internal clock during power loss. Battery life approx. 2 years.
Stop function (stop circuit)	via floating contact, switches off parallel I/O supply, stops schedule

2.2 Power unit

Overview of technical data of power unit

	PSI 6XXX.190 W1
System voltage	400 V -20 % to 480 V +10 % 3-phase
System frequency	50 / 60 Hz
Clock frequency	1000 Hz
DC link voltage	550 V DC to 680 V DC (nominal voltage)
Overvoltage protection	MOV
Temperature monitoring	heat sink
Cooling	water, 4 liters/min max. 40 °C
Nominal current (system side) (max. thermal continuous current)	depending on type of power unit
Switching current	see load diagram in power unit description
Mains connection	U1, V1, W1, potential earth frame terminals conductor area depending on type of power unit
Transformer connection	U2, V2 frame terminals conductor area depending on type of power unit

Your notes:

3   Hardware

3.1   Structure

The PSI 6XXX.190 W1 comprises the following functional units:

-        CPU with centralized control function

-        I/O module

      -        parallel inputs and outputs

-        Field bus interface Profibus FMS or optionally Interbus PMS

-        MF inverter (PSI)

All settings required for operation can be made at the front side or through a connected programming terminal.

3.2   Module front panel without type-specific I/O system
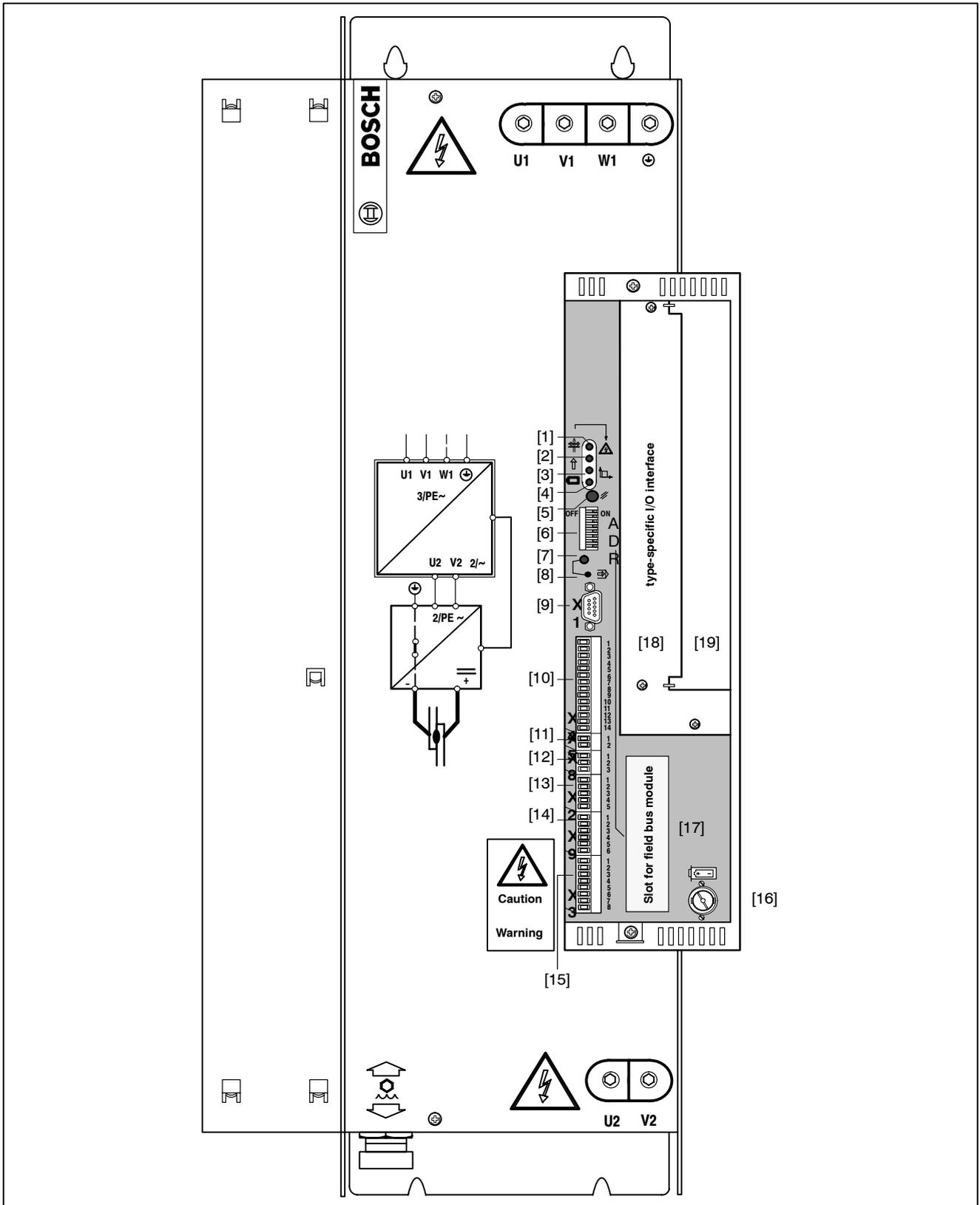
Figure 5: CPU front panel

[1] Line LED, d.c. link voltage (PSI) is present.

[2] Ready LED
timer ready, turns off in case of:
- Internal fault, e.g. dead battery
- Schedule fault, e.g. no current.

[3] Firing LED, Control signal for thyristor unit active

[4] Battery fault LED, backup battery voltage too low

[5] Reset push button, clears pending fault messages, returns timer to ready state.

[6] DIL switch, to set up address of field bus interface (no function with Interbus PMS).

[7] LED red, operating mode timer processor:
- On : timer stopped processing commands.
Timer is in boot mode.
- Off : timer is in operating mode.

[8] Recessed key, switching from operating mode to boot mode:

- Pressing this key turns the system to boot mode.
You should only turn to boot mode for loading a new operating program (firmware).

⚠️ **CAUTION!**

This key may only be operated by authorized personnel.
Never operate this key during a welding operation.
Program execution will be stopped and all control outputs set to zero.

[9] X1 9-pin D shell plug, V24 interface (programming terminal).

[10] X4 14-pin plug-in terminal - power supply:
- +24 VDC supply
  - external
  - standby
- stop circuit
- +24 VDC supply I/O

[11] X5 2-pin plug-in terminal power supply external device.

[12] X8 3-pin plug-in terminal (no function).

[13] X2 5-pin plug-in terminal "pressure":
- analog pressure output, voltage from 0 V to +10 VDC, max. 20 mA (drives pressure regulating valve).
- +24 VDC Pressure feedback input signal

[14] X9   6-pin plug-in terminal (no function).

[15] X3   8-pin plug-in terminal:
          -        transformer temperature, floating contact

[16] Battery compartment;
          use only batteries with Bosch P/N 1070 914 446.

[17] Blanking plate on slot for field bus module.

[18] Elements of type-specific I/O interface.

[19] Blanking plate

3.3   Module front panel type-specific I/Os
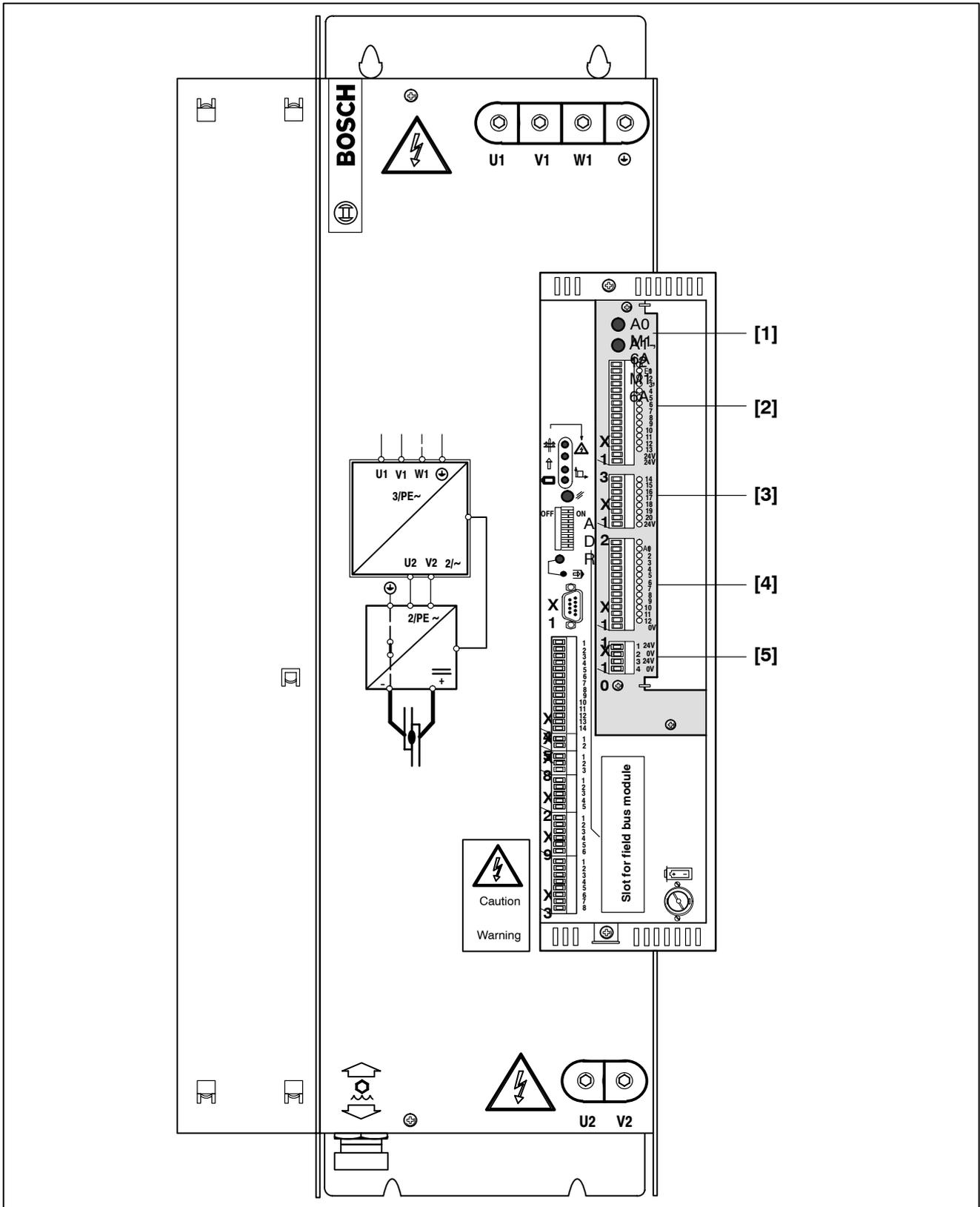
Figure 6: Type-specific I/ interface

[1] Fusing of outputs A0, A1 to A6

- A0 : miniature fuse 5 x 20, M 1.6 A
- A1 to A6 : miniature fuse 5 x 20, M 1.6 A

[2] X13 16-pin plug-in terminal inputs (3.5 mm spacing)

[3] X12 8-pin plug-in terminal inputs (3.5 mm spacing)

[4] X11 14-pin plug-in terminal outputs (3.5 mm spacing)

[5] X10 4-pin plug-in terminal 24 VDC voltage supply (3.5 mm spacing)
for types of connection, see sections 7.3.1 and 7.3.2.

4 Installation

> **CAUTION!**
>
> - Danger of life and of damage to property through insufficient protection class!
>   The protection class of the CPU and the I/O module of the PSI 6XXX.190 W1 modules is IP 00.
>   PSI 6XXX.190 W1 modules must be installed in a power unit.
>
> - 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 or of damage to property due to inappropriate fastening!
>   The place for installing the modules, and their method of fastening, must be suitable for their weight!
>
> - 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.

> **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!
>
> - Interference is frequently coupled and de-coupled in long cables. Therefore, inverter cables and control cables must be routed separately. The influence of interfering cables on cables susceptible to interference can be minimized by keeping the following distances:
>
> - > 100 mm with parallel connection of cables < 10 m
>
> - > 250 mm with parallel connection of cables > 10 m.
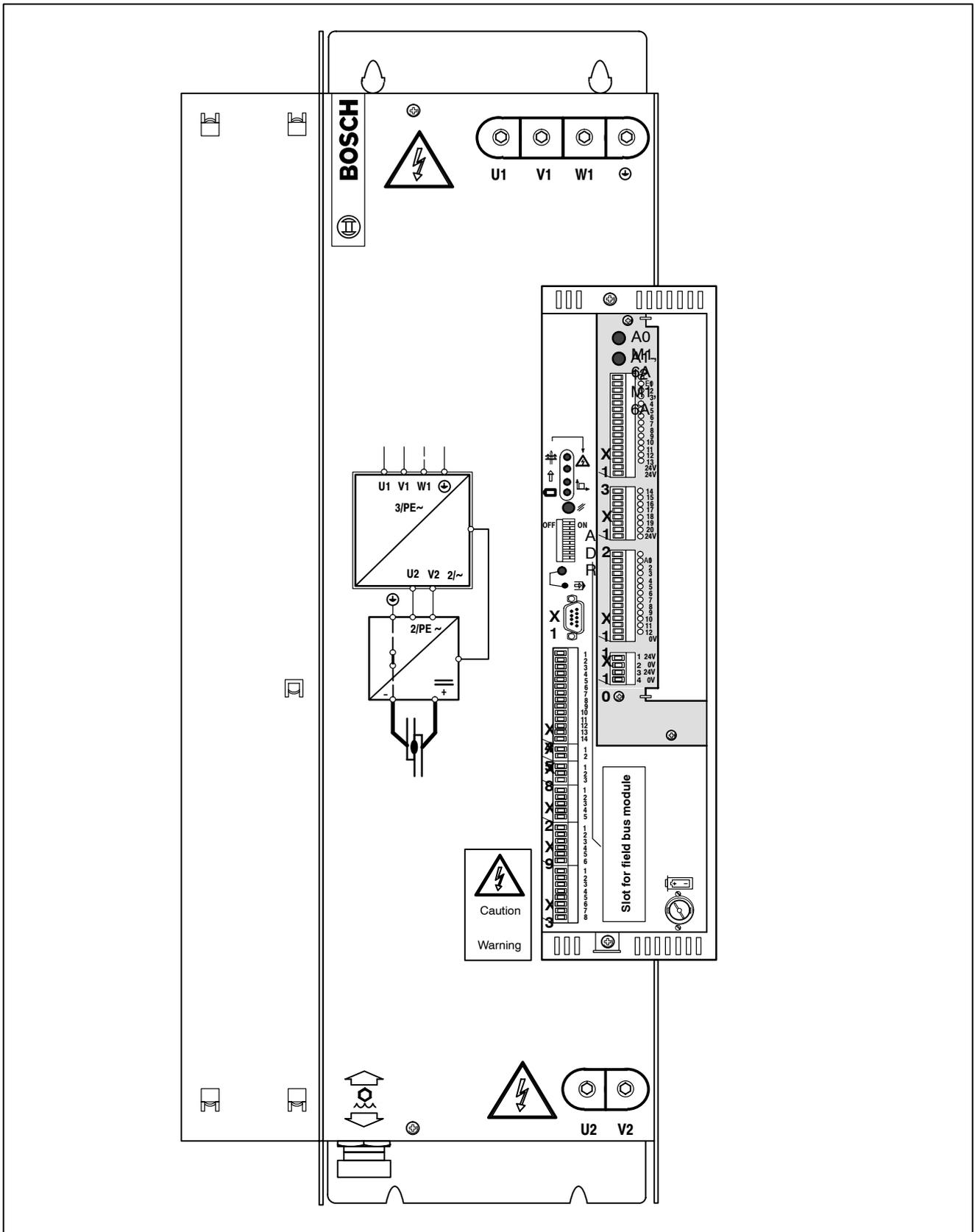
Figure 7: CPU and I/O module in power unit

5 Cables

Cables and cable lengths.

Interface	Cable	Cross section/max. length
X1, programming terminal (V 24)	shielded cable	min. 0.2 mm^2 up to 20 m e.g. 3 x 2 x 0.2 mm^2 LifYCY (Metrofunk) capacitance max. 2.5 nF
X2, pressure analog pressure output	shielded cable	0.5 mm^2 up to 50 m 0.75 mm^2 up to 100 m e.g. NFL 13 (Metrofunk) or LiYCY
Pressure input	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.5 mm^2
Transformer temperature	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.5 mm^2
X4, power supply	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.75 mm^2 up to 10 m 1.5 mm^2 up to 75 m
X5, external device	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.75 mm^2 up to 10 m 1.5 mm^2 up to 75 m
X10, power supply	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.75 mm^2 up to 10 m 1.5 mm^2 up to 75 m
X11, parallel outputs A0	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.5 mm^2 up to 30 m 1.0 mm^2 up to 50 m 1.5 mm^2 up to 100 m
A1 to A12 (+24 V/0.1 A)	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.5 mm^2 up to 100 m
X12, X13, parallel inputs E0 to E20	unshielded cable, VDE 0281, 0812 e.g. Ölflex	0.5 mm^2 up to 100 m

Your notes:

6   Suppression of RF noise

Means of noise suppression are required to prevent radiation of radio frequency noise. Such noise is caused by transients peaks, which are transmitted by the power supply line.

Noise should be neutralized at the source. If this is not practical, the noise suppression devices must be placed as close as possible to the source.

All inductive devices such as valves, solenoids and other switching elements (or their connecting wires), which are situated in the vicinity of the timer require noise suppression.

Because of inherent vibrations of the machine, the mounting of all noise suppression devices must be resistant to fracture.
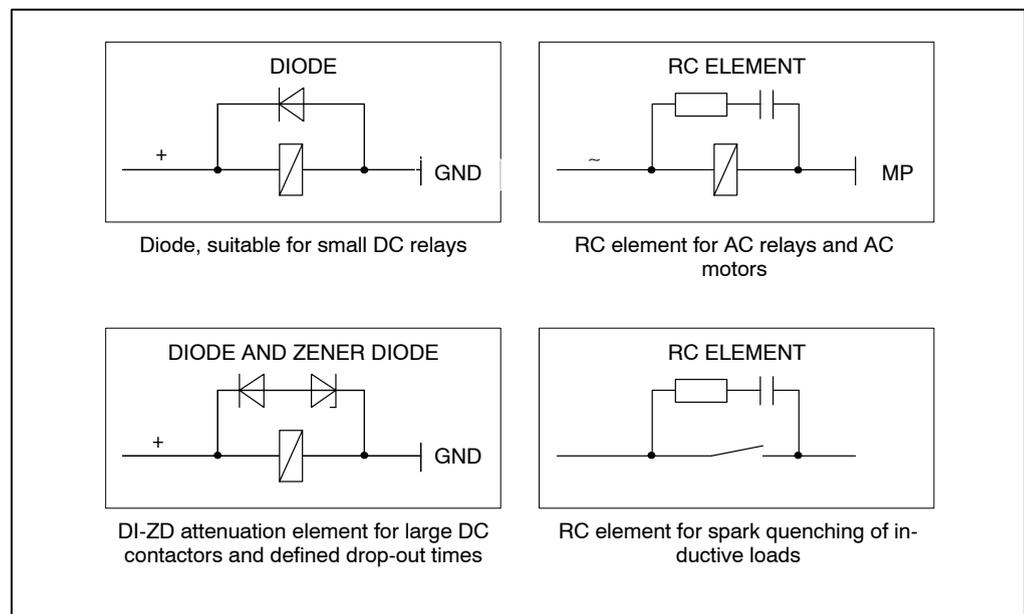
Figure 8: Examples of noise suppression

Voltage	Resistor	Capacitor	Diode
24 VDC	-	-	1 N 5060/ZL 12
48 VDC	-	-	1 N 5060/ZL 22
110 VAC	220 Ω/1 W	0.5 μF 400/600 V	
220 VAC	220 Ω/5 W	0.1 μF 500 V	
440 VAC	220 Ω/5 W	0.1 μF 1000 V	

This table serves only as an example. The actual component values depend on the specific load conditions.

Your notes:

7   Electrical connection

In this section, you will find a description of the CPU ports, various connection options for power supply, and the functions of the parallel I/O interface.

> **WARNING!**
>
> - Working with system voltage may result in death, severe bodily injury or considerable damage to property unless the appropriate precautionary measures are taken.
>   Therefore, you should carefully read the safety instructions at the beginning of this manual where you will find a description of a number of features to be strictly observed! The system voltage is associated with considerable 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 equipment must be appropriately fused at the mains side!
>
> - Danger of life through electrical voltage!
>   When working at the mains system or making connections involving the welding plant it must be ensured that the inverter has been safely isolated from the supply for at least 5 minutes (capacitor discharge time).
>
> - Suitable insulated tools must be used for all electrical connection work!

PSI 6200.190 W1

<Start> E0
<Block selection_1> E1
<Block selection_2> E2
<Block selection_4> E3
<Program selection_1> E4
<Program selection_2> E5
<Program selection_4> E6
<Program selection_8> E7
<Program selection_16> E8
not used E9
not used E10
not used E11
not used E12
<Block start> E13
24V
24V

Intputs +24 VDC/20 mA

X13

<Reset fault with WC> E14
<Weld/No weld external> E15
<Monitoring contact> E16
not used E17
not used E18
not used E19
not used E20
24V

X12

<Solenoid +24 VDC/1 A max.> A0
<Weld complete WC> A1
not used A2
<Control ready> A3
<Welding fault> A4
<Weld / No weld> A5
<w/o monitoring> A6
not used A7
not used A8
not used A9
not used A10
not used A11
not used A12
0V

Outputs 24 VDC/0.1 A

X11

Terminals without a description have no function

+24 VDC External 24V
0 V External 0V
+24 VDC External 24V
0 V External 0V

X10

Mains
U1
V1
W1

Pin2 RX
Pin3 TX
Pin5 GND

X1
V_24

*1 stop circuit:
floating contact
load:
24 VDC / max. 3A

X4
1 +24 VDC I/O
2 0 V
3
4 *1
5
6 Jumper +24 VDC int. power supply
7
8 Jumper 0 V internal power supply
9
10 Jumper +24 VDC int. power supply
11
12 Jumper 0 V internal power supply
13
14

Electrical power supply of logics

X5
1 +24 VDC
2 0 V
External device,
24 VDC, max. 2 A

X8
1
2
3

X2
Pressure
1 <Analog pressure output>
2 0V
3
4 <Pressure input>
5

X9
1
2
3
4
5
6

X3
1
2
3
4
5 Transformer temperature
6
7
8

U2
V2
Welding
transformer

Note: Relays and contactors require RFI suppression, e.g. free-wheeling diode for
small relays and contactors, RC combinations or MOV for AC relays and contactors.

For power supply options, see section 7.2

Figure 9: Connection diagram

7.1   Interfaces
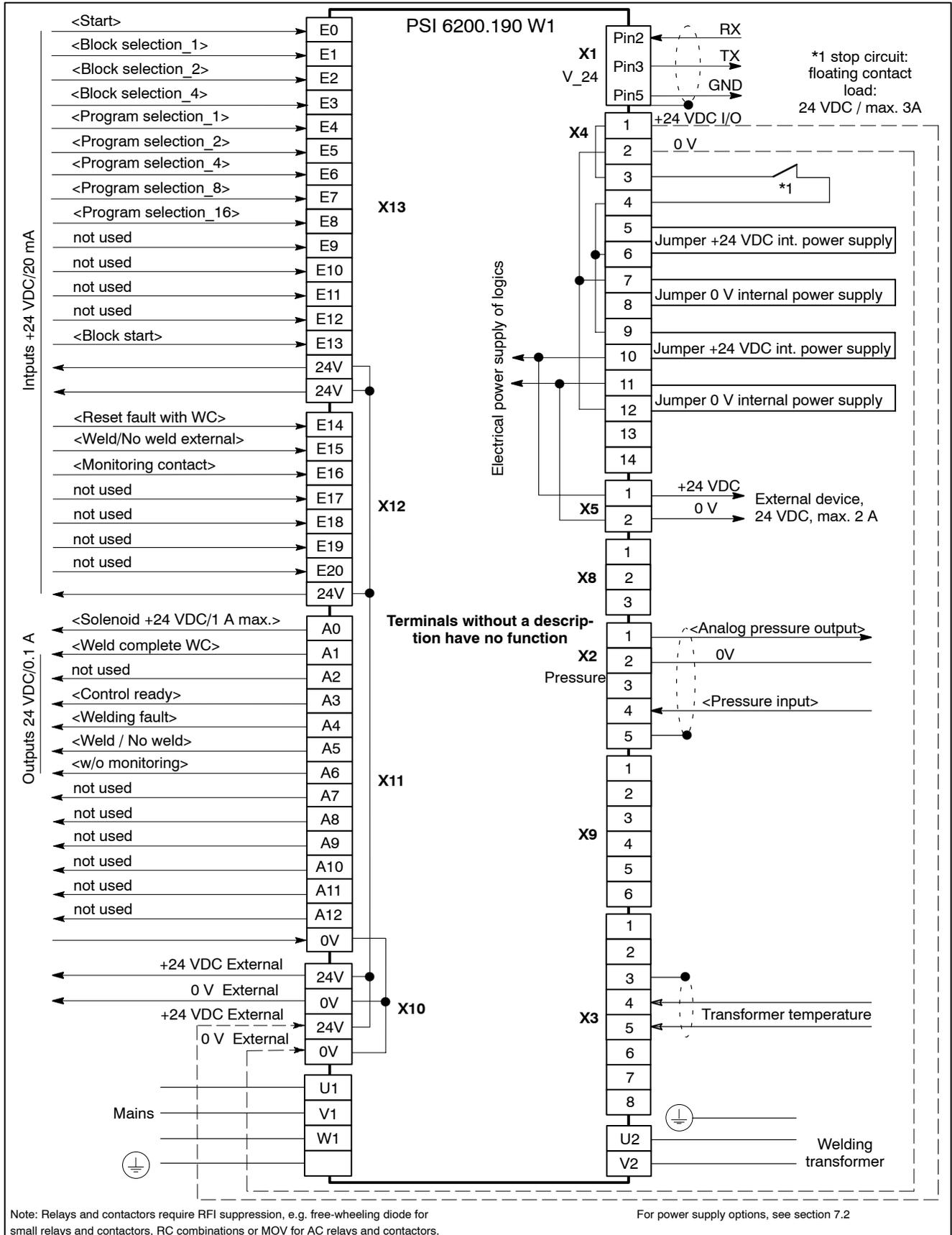
7.1.1   Programming terminal X1

V24 interface

For the cable type and the maximum cable length, please refer to the table "Cables", see section 5.

Both ends of the shield conductor must be connected to the conductive connector shell. The connector should be screwed to the unit to improve the shielding efficiency.
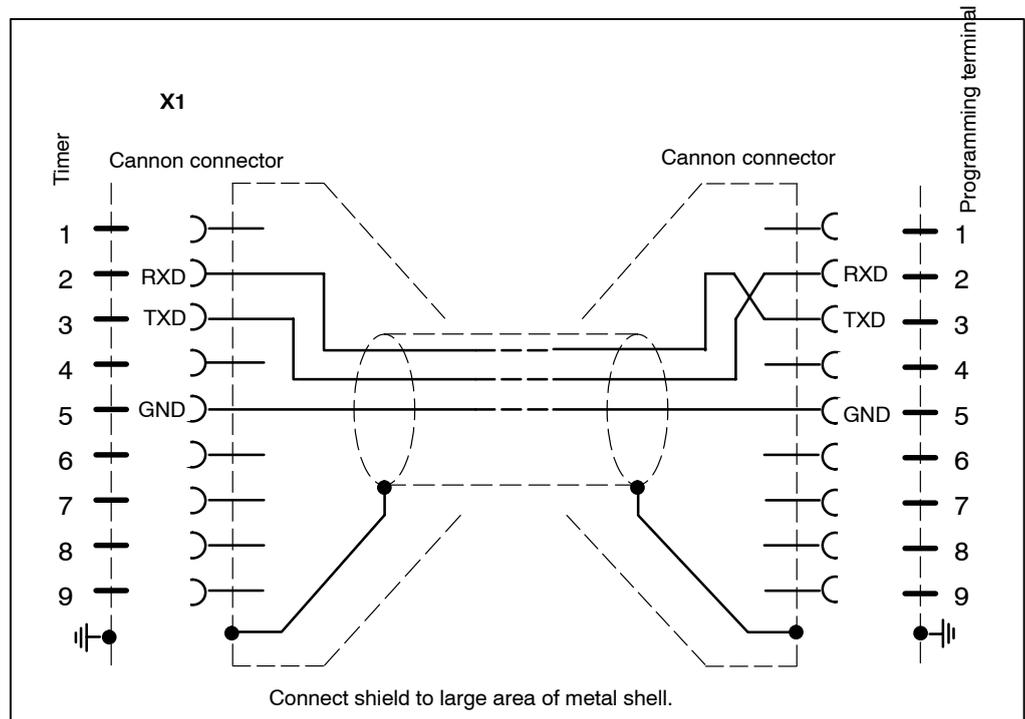

Figure 10: Connection of the V24/RS232 interface

7.1.2   Pressure X2

For cable type and maximum cable length, please refer to the table "Cables", see section 5.

The connection between PSI 6XXX.190 W1 and the pressure control valve consists of a shielded cable. The shield is connected to X2/5 and the shield ground at the pressure control valve.

Pressure output

Depending on the programming and timer type used, an output signal is provided at the pressure output if the program number has been selected:

-       analog pressure output, voltage from 0 V to +10 VDC, max. 20 mA

The pressure output is immediately driven when the program has been selected externally.

Pressure input

A +24 signal (20 mA) at input X2/4 serves as an input to the WT by which an external force and comparison device signals that the specified pressure/force value has been reached at the electrodes. This **<Pressure input>** signal is linked by a logic AND with the **<Monitoring contact>** in the WT and acts together with it as a condition for Start of the SQZ.

When operated without this external force measuring and comparison device (without pressure control valve), input X2/4 has to be permanently supplied with a +24V signal, and terminal X2/2 has to be connected to the 0 V potential of the 24 VDC supply.

The logic condition of the pressure input can be checked using *Operation - Diagnostics I/Os- Inputs (I08)*.

While the PSI 6XXX.190 W1 waits for the pressure input, selecting *Operation - Diagnostics - Timer* will show Status: *Waiting for pressure contact* in the Current sequence - Interval: SQZ display field.
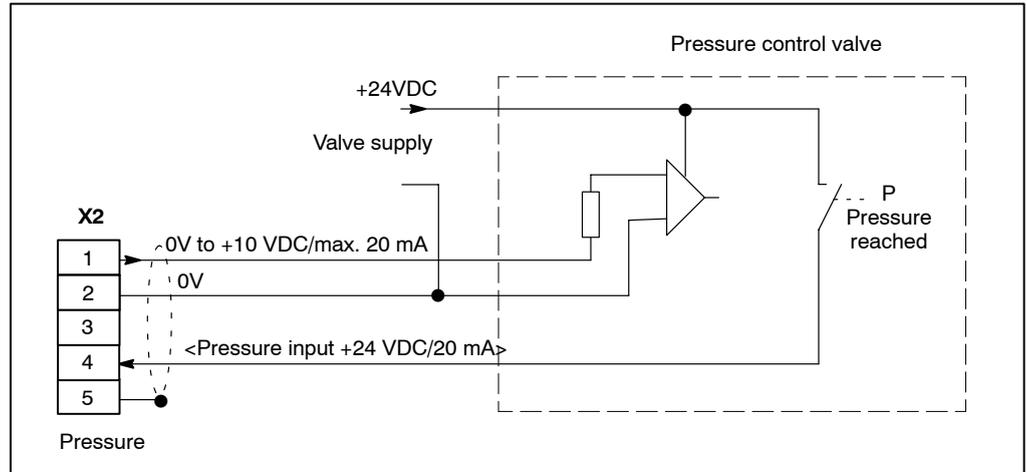
Figure 11: Connection of pressure control valve with feedback
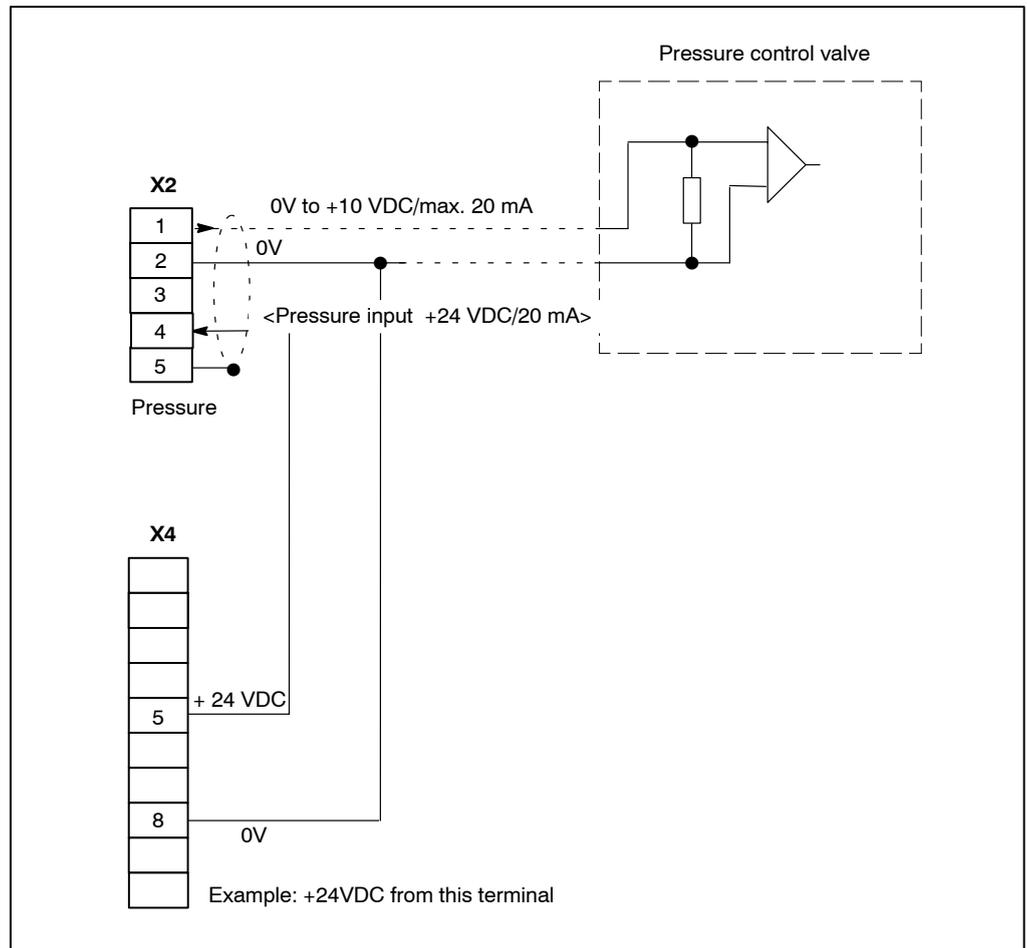
Figure 12: Connection of pressure control valve without feedback, or operation without pressure control valve

7.1.3   Transformer temperature X3

Temperature monitoring by a floating contact (ncc) in the welding transformer.
Transformer temperature too high:

- [Schedule] is aborted
- No **<Start>** is possible.

7.1.4   Power supply X4

see section 7.2

7.1.5   External device X5

+24 V DC are output at interface X5 for supplying an external unit (maximally 2A, depending on the external supply).

7.1.6   Stop circuit

A fault in the stop circuit is automatically reset when corrected.

7.1.7   DC link voltage

The DC link voltage is permanently monitored. A fault in the DC link voltage is automatically reset when it has been corrected.

7.2   Power supply

7.2.1   Internal power supply

Configuration A

The power supply to PSI 6XXX.190 W1 is completely provided by the power unit (internal supply).

PSI 6XXX.190 W1 is internally supplied with 24 V DC (derived from the mains voltage). Several jumpers have to be positioned to enable the internal power supply.

-   When the welding network is switched off, the 24 V DC supply is interrupted:
    -   no communication via I/O interfaces possible
    -   no communication between the timer and the programming terminal, e.g. programming and visualization possible.

-   Preferably used with stand-alone systems, e.g. suspended welding stations.

-   The **Stop function** is ensured by means of a **floating contact** which is to be connected to terminals X4/3 and X4/4.

-   Opening the stop contact will interrupt:
    -   the **firing**
    -   the **power supply** to the **parallel inputs and outputs**
    -   the **power supply** to the external unit.

Figure 13: Internal power supply

7.2.2 External power supply

Configuration B

The power supply to PSI 6XXX.190 W1 is provided by an external unit (external supply). Several jumpers have to be positioned to enable the external power supply.

The power supply to the timer is thus independent of the welding network.

For configuration B, the external power supply must satisfy the following requirements:

- Maximum ripple <5 %, tolerance -15 % / +20 %.
    - Making current: approx. 2.0 A, duration approx. 10 ms, plus the current of the inputs and outputs and the current of the external unit connected to X5.
    - continuous current: approx. 1.5 A, plus the current of the inputs and outputs and the current of the external unit connected to X5.

NOTE

For determining the power supply rating, sum up the individual loads required.

Functions:

- No interfaces are interrupted when the welding network is switched off:
    - communication via I/O interfaces is possible
    - communication between the timer and the programming terminal, e.g. programming and visualization is possible.

- Preferably used in networked systems
    - only one non-floating 24 V DC supply for the entire system

- The **Stop function** is ensured by means of a **floating contact** which is to be connected to terminals X4/3 and X4/4.

- Opening the stop contact will interrupt:
    - the **firing**
    - the **power supply** to the **parallel inputs and outputs**
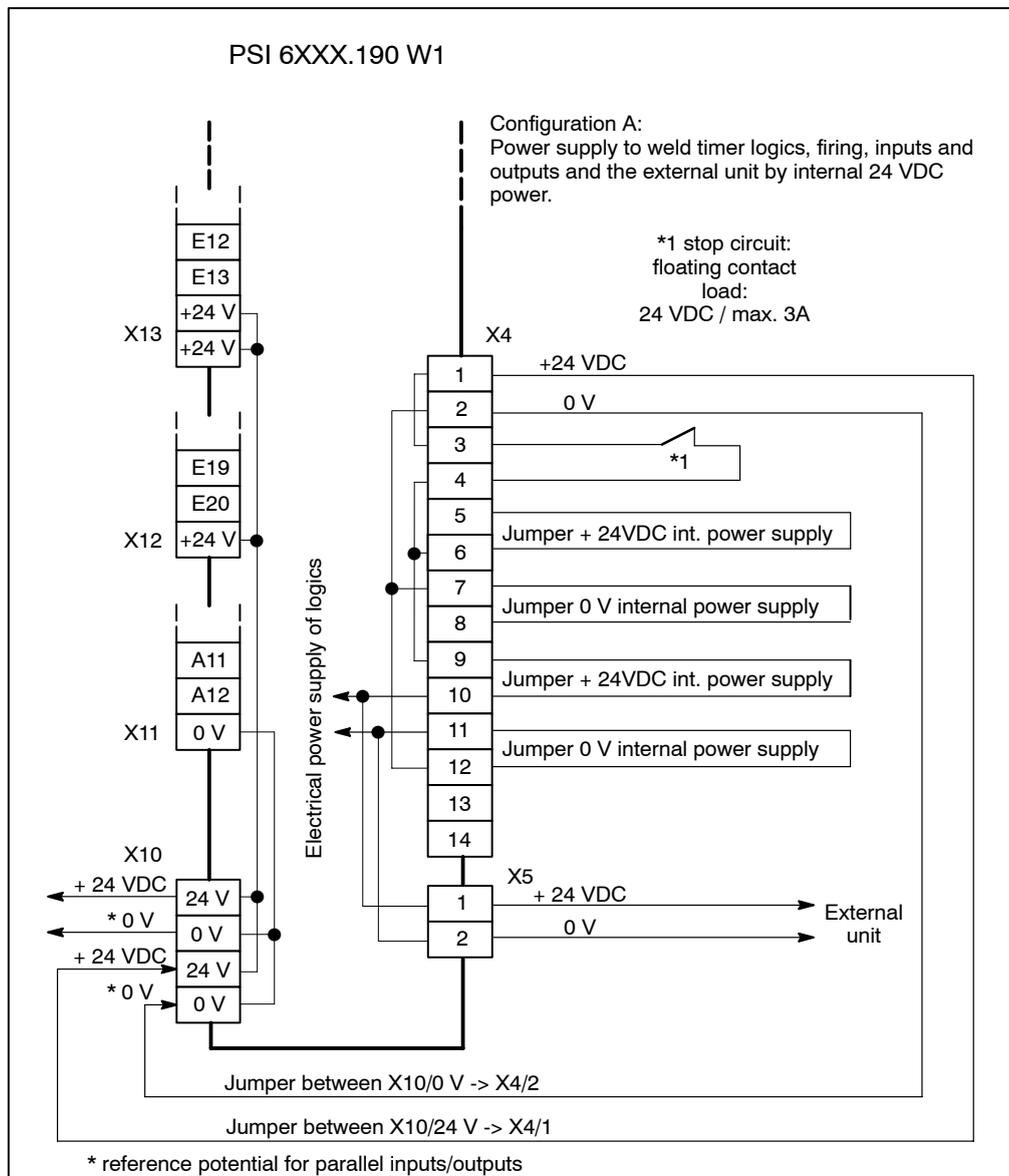   - the **power supply** to the external unit.

PSI 6XXX.190 W1

Configuration B:
Power supply to weld timer logics, firing, inputs and outputs and the external unit by an external 24 VDC power supply unit.

*1 stop circuit:
floating contact
load:
24 VDC / max. 3A

Power supply
unit
+   -

X13	E12
	E13
	+24 V
	+24 V

X12	E19
	E20
	+24 V

X11	A11
	A12
	0 V

Electrical power supply of logics

X4	1	+ 24 VDC
	2	0 V
	3	
	4	*1
	5	
	6	+ 24 VDC
	7	0 V
	8	
	9	
	10	Jumper +24VDC ext. power supply
	11	Jumper 0 V external power supply
	12	
	13	
	14	

X10	
+ 24 VDC	24 V
* 0 V	0 V
+ 24 VDC	24 V
* 0 V	0 V

| X5 | 1 | + 24 VDC | External unit |
| | 2 | 0 V | |

Jumper between X10/0 V -> X4/2

Jumper between X10/24 V -> X4/1

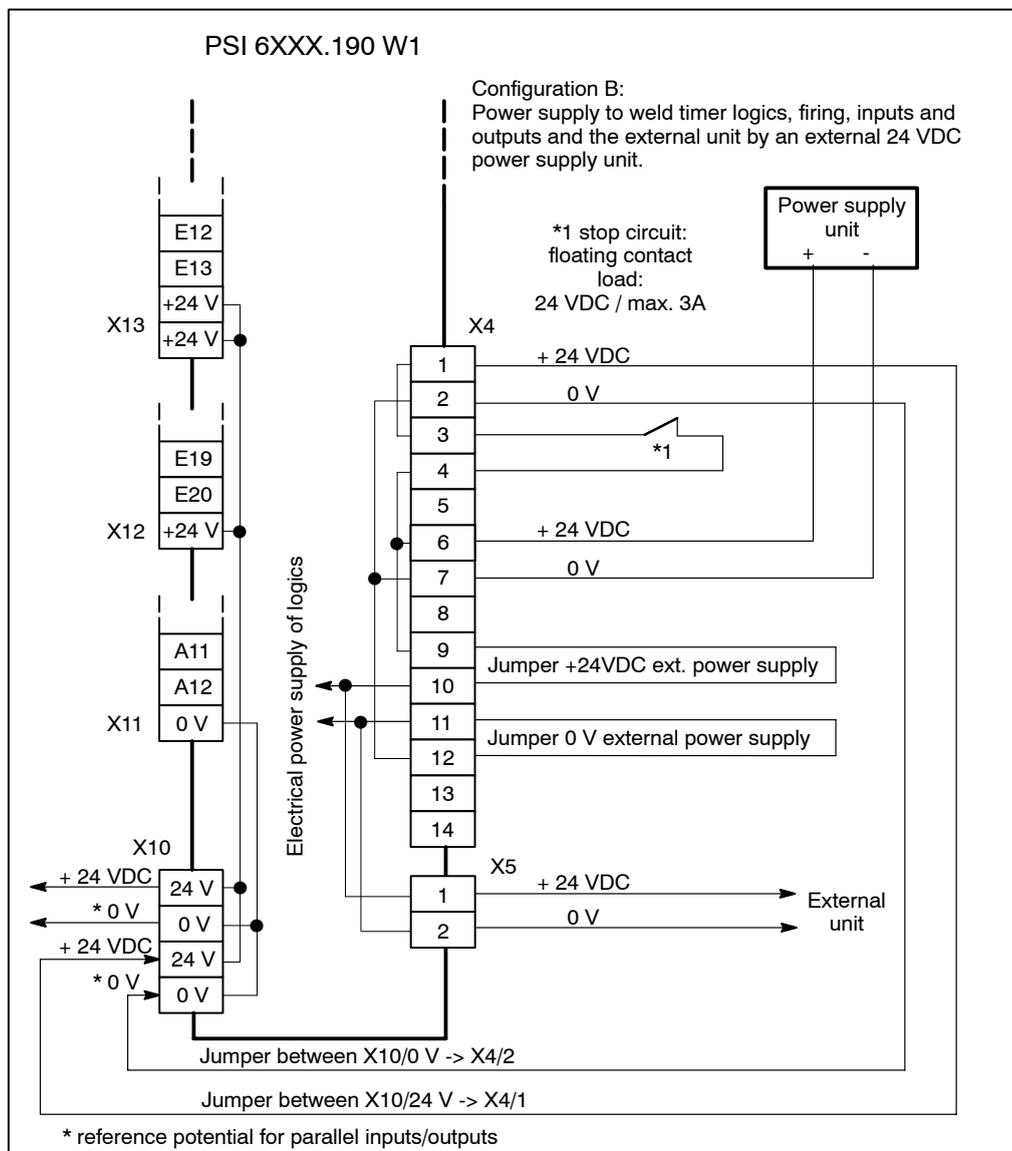* reference potential for parallel inputs/outputs

Figure 14: External power supply

Configuration C

The I/O range of the PSI 6XXX.190 W1 is supplied with a voltage of 24 V DC (internal supply, derived from the mains voltage). Several jumpers have to be positioned to enable this configuration.

The logic portion is supplied by an external 24 V DC power supply unit (external power supply). The power supply to the timer logic is therefore independent of the welding network.

In configuration C, the timer logic is supplied by an external 24 V DC power supply unit **[1]**.

In configuration C, the external power supply unit must satisfy the following requirements:

- maximum ripple <5%, tolerance -15% / + 20%.
    - Making current: approx. 2.0 A, duration approx. 10 ms, plus the current of the external unit connected to X5.
    - continuous current: approx. 1.5 A, plus the current of the external unit connected to X5.

NOTE

For determining the power supply rating, sum up the individual loads required.

Functions:

- When the welding network is switched off, the following interfaces will be interrupted:
    - no communication via the parallel I/O interfaces possible.

- Communication between the weld timer and the programming terminal is possible, e.g. programming and visualization is possible.

- Preferably used with networked systems.

- The **Stop function** is ensured by means of a **floating contact** which is to be connected to terminals X4/3 and X4/4.

- Opening the stop contact will interrupt:
    - the **firing**
    - the **power supply** to the **parallel inputs and outputs**
    - the **power supply** to the external unit.

PSI 6XXX.190 W1

Configuration C:
Power supply for firing, parallel inputs and outputs by internal 24 VDC power.
Power supply to weld timer logics and the external unit by an external power supply unit **[1]**.

*1 stop circuit:
floating contact
load:
24 VDC / max. 3A

X13	E12
	E13
	+24 V
	+24 V

X12	E19
	E20
	+24 V

X11	A11
	A12
	0 V

X4

1	+ 24 VDC
2	0 V
3	
4	*1
5	
6	Jumper +24 VDC int. power supply
7	
8	Jumper +24 VDC int. power supply
9	
10	+ 24 VDC
11	0 V
12	
13	
14	

Electrical power supply of logics

+ Power supply unit - **[1]**

X10

24 V	+ 24 VDC
0 V	* 0 V
24 V	+ 24 VDC
0 V	* 0 V

X5

1	+ 24 VDC
2	0 V

External unit

Jumper between X10/0 V -> X4/2

Jumper between X10/24 V -> X4/1

* reference potential for parallel inputs/outputs

Figure 15: Internal and external power supply

Configuration D

If the external 24 V DC supply to PSI 6XXX.190 W1 cannot be provided by one power supply unit for reasons of potential separation between the timer logic and the I/O supply, the power supply has to be designed in accordance with configuration D. Several jumpers have to be positioned to enable this configuration.

The power supply to the timer is thus independent of the welding network (external power supply).

In configuration D, the external power supply unit **[1]** must satisfy the following requirements:

-    maximum ripple <5%, tolerance -15% / + 20%.
    -    Making current: approx. 0.2 A, duration approx. 10 ms, plus the current of the inputs and outputs.
    -    continuous current: approx. 0.1 A, plus the current of the inputs and outputs.

In configuration D, the external power supply unit **[2]** must satisfy the following requirements:

-    maximum ripple <5%, tolerance -15% / + 20%.
    -    Making current: approx. 2.0 A, duration approx. 10 ms, plus the current of the external unit connected to X5.
    -    continuous current: approx. 1.5 A, plus the current of the external unit connected to X5.

┌─ **NOTE** ───┐

For determining the power supply rating, sum up the individual loads required.
───

Functions:

-    When the welding network is switched off, no interfaces will be interrupted:
    -    communication via the I/O interfaces is possible
    -    communication between the timer and the programming terminal, e.g. programming and visualization, is possible.

-    Preferably used with networked systems.

-    The **Stop function** is ensured by means of a **floating contact** which is to be connected to terminals X4/3 and X4/4.

-    Opening the stop contact will interrupt:
    -    the **firing**
    -    the **power supply** to the **parallel inputs and outputs**
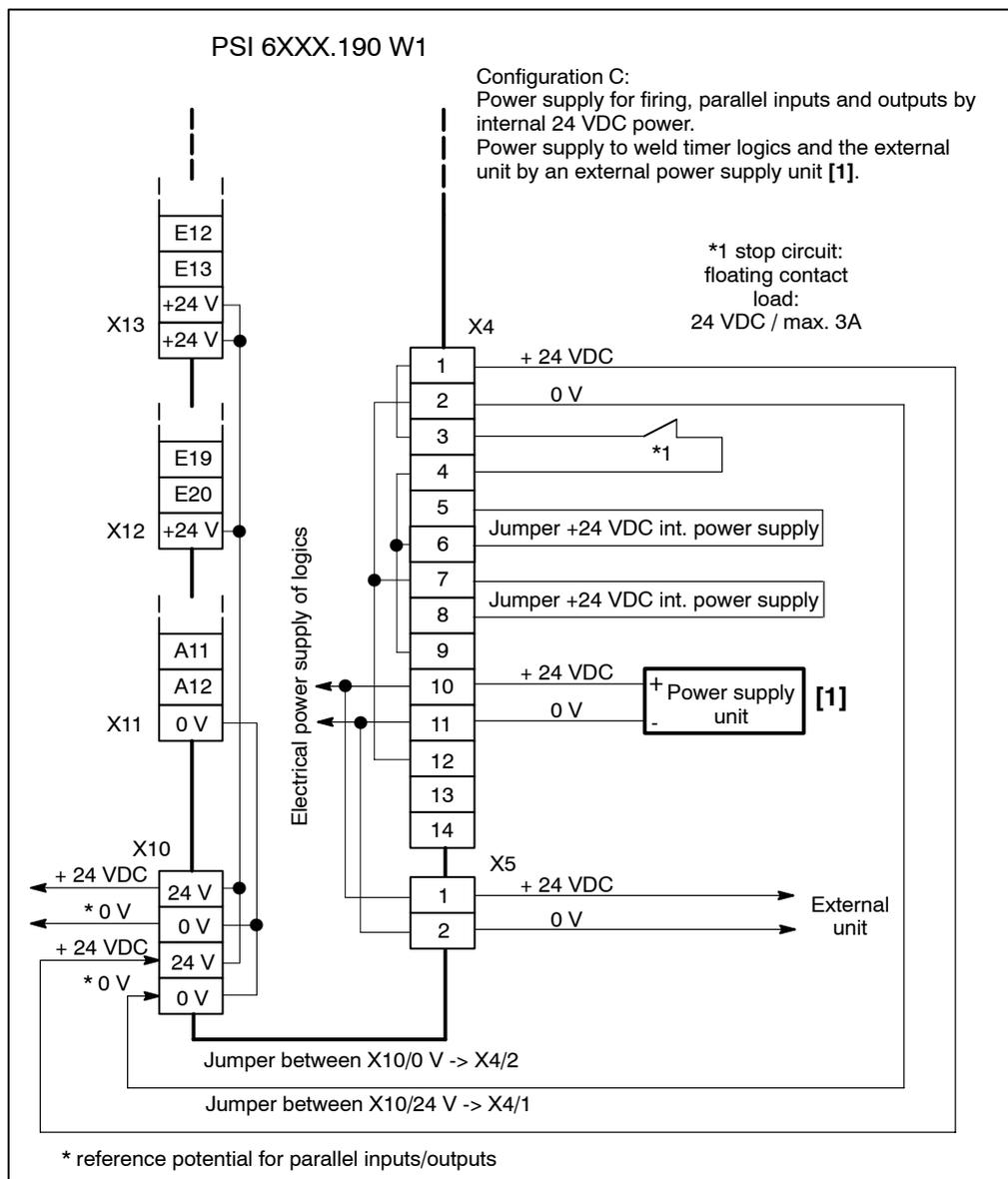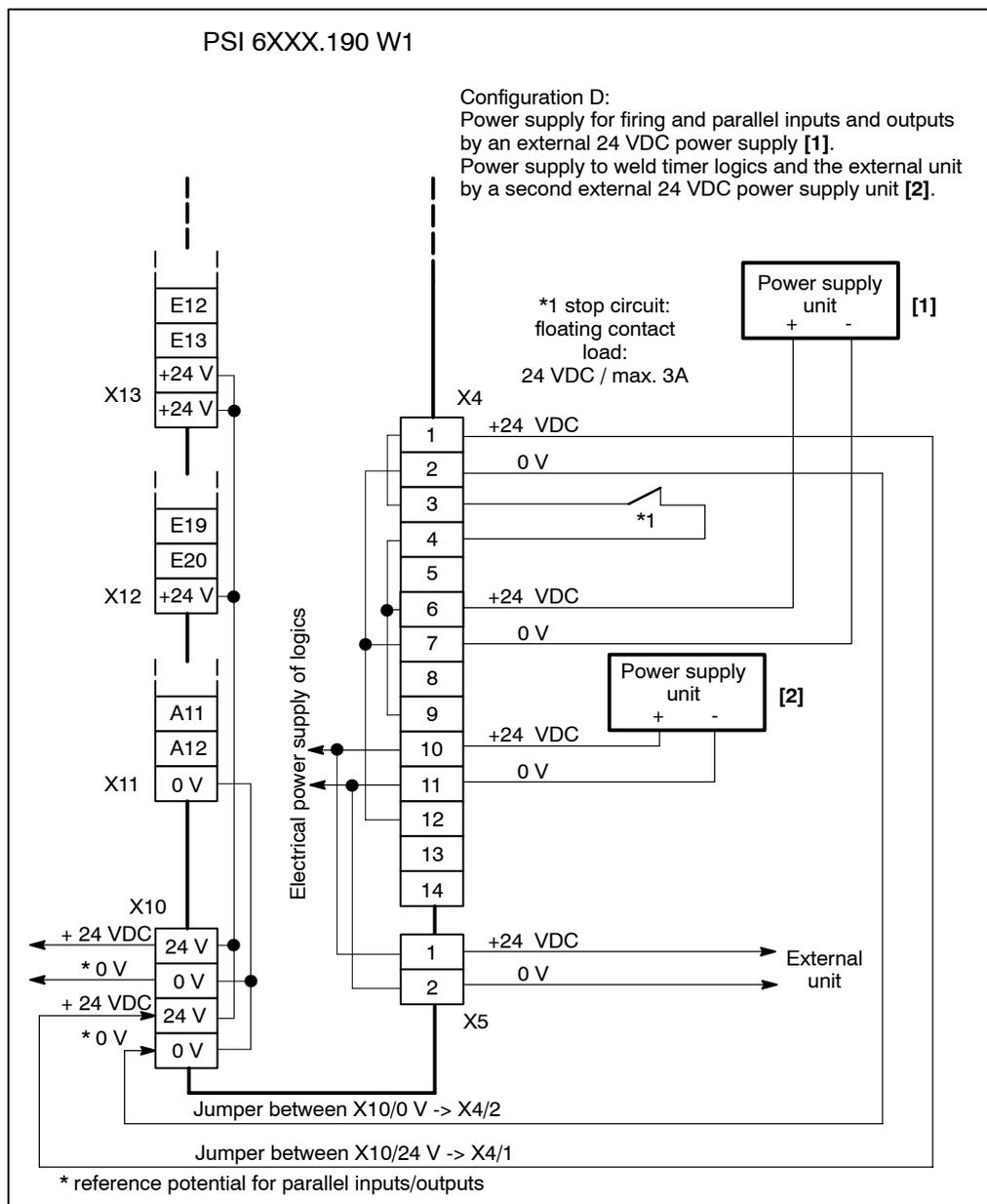   -   the **power supply** to the external unit.

PSI 6XXX.190 W1

Configuration D:
Power supply for firing and parallel inputs and outputs by an external 24 VDC power supply **[1]**.
Power supply to weld timer logics and the external unit by a second external 24 VDC power supply unit **[2]**.

*1 stop circuit:
floating contact
load:
24 VDC / max. 3A

Power supply unit **[1]**
+   -

E12
E13
+24 V
X13 +24 V

E19
E20
X12 +24 V

A11
A12
X11 0 V

Electrical power supply of logics

X4
1   +24 VDC
2   0 V
3
4   *1
5
6   +24 VDC
7   0 V
8
9
10   +24 VDC
11   0 V
12
13
14

Power supply unit **[2]**
+   -

X10
+ 24 VDC 24 V
* 0 V   0 V
+ 24 VDC 24 V
* 0 V   0 V

X5
1   +24 VDC
2   0 V

External unit

Jumper between X10/0 V -> X4/2
Jumper between X10/24 V -> X4/1
* reference potential for parallel inputs/outputs

Figure 16: External power supply by two power supply units

7.3   I/O functions

> **NOTE**
>
> *Electromagnetically activated switching and positioning devices require noise suppression (see section 6).*

The selection of cables and the cable lengths are subject to the "Cables" table in section 5.

7.3.1   Parallel inputs

Selecting seam programs

In the PSI 6XXX.190 W1 the parameters for 32 seam programs can be programmed and selected for the [sequence]. Seam programs are selected with **<Program selection>** in combination with **<Block selection>**.

Each seam program consists of a basic program (**<Program selection>**) and up to 7 block programs (**<Block selection>**).

The higher-level welding parameters have been programmed in the basic programs. The current block parameters required for the [sequence] are programmed in the block programs, refer to sections 9.1 and 9.2.

All seam programs work with electrode number 0.

Changing the **<Block selection>** can be done within a running basic program without interrupting the current. Changing the **<Block selection>** comprises the block programs assigned to the basic program, cf. assignment on page 7-16.
When changing the block programs, the current impulse just started is completely welded, and then the new block program is started.

Seam program, assignment of block programs to basic programs:

Seam program	Basic program	Block program
0	0	1 to 7
1	8	9 to 15
2	16	17 to 23
3	24	25 to 31
4	32	33 to 39
5	40	41 to 47
6	48	49 to 55
7	56	57 to 63
8	64	65 to 71
9	72	73 to 79
10	80	81 to 87
11	88	89 to 95
12	96	97 to 103
13	104	105 to 111
14	112	113 to 119
15	120	121 to 127
16	128	129 to 135
17	136	137 to 143
18	144	145 to 151
19	152	153 to 159
20	160	161 to 167
21	168	169 to 175
22	176	177 to 183
23	184	185 to 191
24	192	193 to 199
25	200	201 to 207
26	208	209 to 215
27	216	217 to 223
28	224	225 to 231
29	232	233 to 239
30	240	241 to 247
31	248	249 to 255

<Program selection 0 to 31> Basic program

The **<Program selection>** is made by parallel signals with a binary value in the range of 0 to 31. If the **<Start>** becomes active in connection with the selected program number, the selected basic program is started with the higher-level welding parameters.

<Block selection> and **<Block start>** have to be additionally given for a [sequence] with welding current.
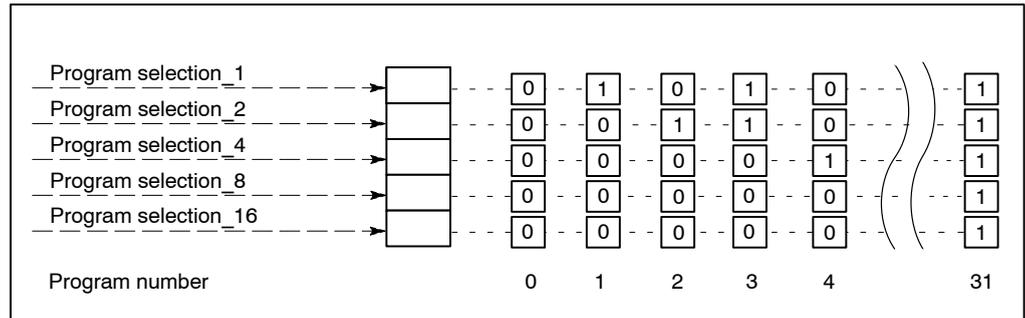

Figure 17: Example Program selection

By selecting the program number, the analog pressure output is driven with the programmed pressure/force value.

<Block selection 0 to 7> Block program

A **<Block selection>** is made through parallel signals with a binary value in the range of 0 to 7. This selection serves to select a block program that has been permanently assigned to the basic program.

If the **<Block start>** becomes active in connection with the selected block number, the selected block program (1 to 7) is executed for as long as **<Start>** is active.
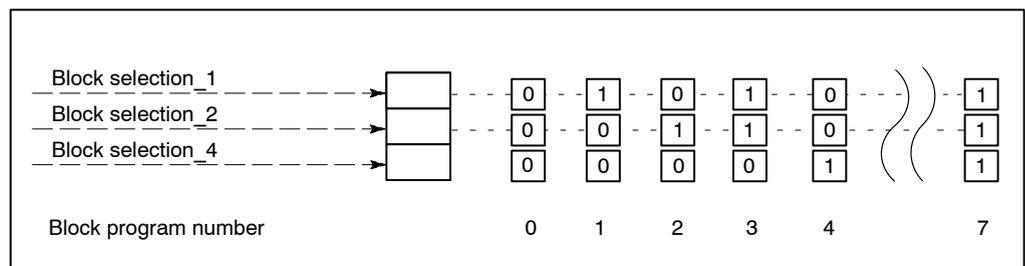

Figure 18: Example block program selection

A **<Block selection>** of 0 will finish the running block program. The **<Solenoid>** is driven the whole time **<Start>** is active, but no welding current flows unless a new **<Block selection>** is selected and the new block program is started with **<Block start>**.

<Start> and <Block start>

<Start> initiates the [sequence] in the weld timer, and activates the **<Solenoid>**. By giving the **<Start>**, the **<Program selection>** for the basic program is taken over, and the pre-squeeze time [1. SQZ] is started. The **<Start>** can be cleared and the [sequence] interrupted within the [1. SQZ] and the squeeze time [SQZ].

If no **<Block start>** is available at the end of the [SQZ], the [SQZ] will be extended until the **<Block start>**.

Upon **<Block start>**, the **<Block selection>** is read, and the block delay time [BDT] is started. This process is followed by the weld times and cool times of the block program, until the **<Block selection>** is available without any changes, and <Start> is active.

For programming of [BDT], weld times and cool times, refer to section 9.2.

If the **<Start>** is cleared during a current block, the [sequence] of the seam program is finished in the current block.

A [sequence] can be started with or without firing:

-     Start with firing turned on   : [sequence] with welding current
-     Start without firing turned on   : [sequence] without welding current
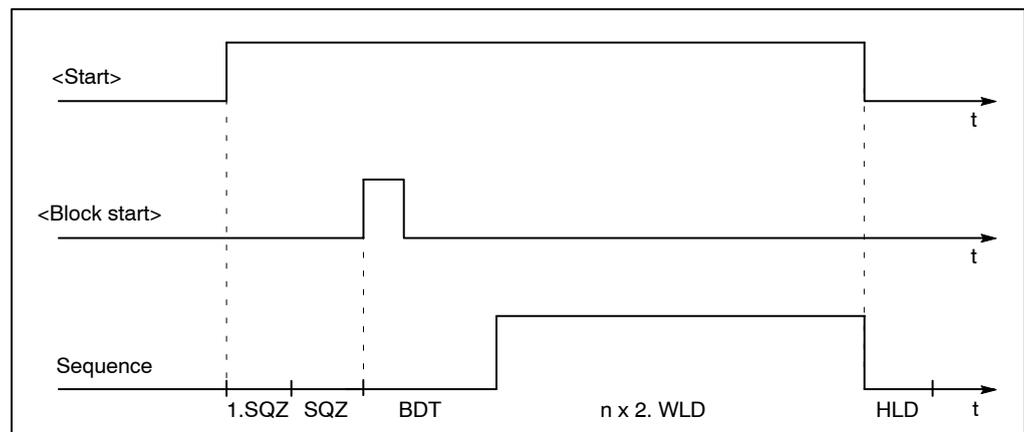
For firing, please refer to page 7-21.
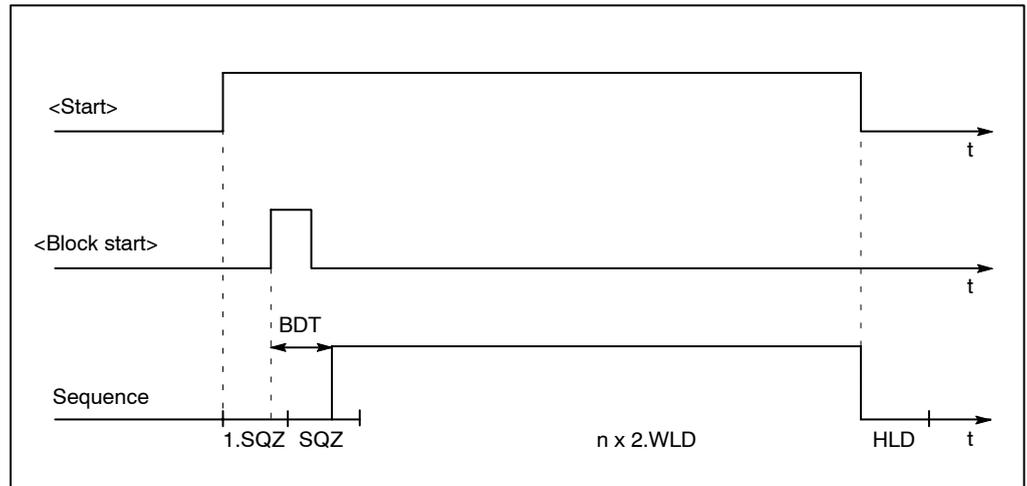

Figure 19: Start and Block start
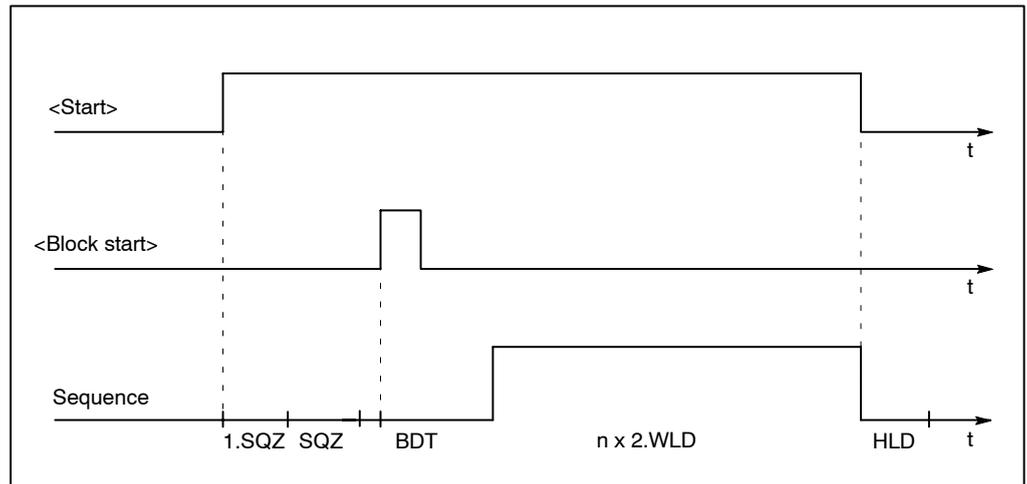
Figure 20: Block start during squeeze times

Figure 21: Block start after squeeze times

Response times

Changing the **\<Block selection\>** within a started basic program can be done without interrupting the current.

The present current pulse is finished after the programmed weld time. The same applies to the cool time. Afterwards, the new block program will be started with the block delay time [BDT].

The input circuitry and the sequence in the PSI 6XXX.190 W1 results in the following response time to a change of the **\<Block selection\>**:

$$T_{RMAX} = T_{HW} + T_{AB} + T_{PROZ} + T_{O} + T_{PROG}$$

T_{RMAX} = maximum response time to a change in the **\<Block selection\>**

T_{HW} = fixed hardware response time of 3 ms, depending on the type of I/O module

T_{AB} = variable software response time of 0 to 4 ms

T_{PROZ} = variable process response time, 0 to total time of the current welding pulse plus cool time (WLD + CT). The present current block is not interrupted by a block change.

T_{O} = Offset
- 10 ms with [BDT]   > 0
- 0 ms   with [BDT]   = 0

T_{PROG} = Programmed [BDT] in ms

<Weld/No weld external>

This signal allows to disable the firing of the welding timer as for example during set-up operations ([sequence] without current).

In addition to the **<Weld/No weld external>** signal, the setting of weld/no weld internal for all programs and furthermore the weld/no weld internal setting for an individual program affect the firing.

These three firing settings are linked by "AND".

If weld has been deactivated, the time [sequence] of the program will remain identical to the [sequence] with activated firing. However, no welds are performed, there is no welding current.

- No weld external   : 0 signal

- Weld external   : 1 signal

For all timers		Program-related firing	Program-related sequence
External weld	Weld internal		
off	off	off	Sequence **without** welding current
off	off	on	Sequence **without** welding current
off	on	off	Sequence **without** welding current
off	on	on	Sequence **without** welding current
on	off	off	Sequence **without** welding current
on	off	on	Sequence **without** welding current
on	on	off	Sequence **without** [1] welding current
on	on	on	Sequence **w i t h** welding current
[1] Caution: Program-related firing may be active for other programs			

Figure 22: Firing settings

<Reset fault with weld complete contact>

Resetting of a fault is required, whenever a fault prevents any further welding [sequences] in the timer.

Pending faults are reset by

-        software BOS-5000

-        using the green button on the front panel of the PSI 6XXX.190 W1 or

-        **<Reset fault with weld complete contact>**

This signal resets the displayed fault. The cause of the fault must be cleared first. The **<Weld complete> (WC)** signal will be output when **<Start>** has been cleared, the welding timer is switched into ready state. A new [sequence] can be started.

<Monitoring contact>

When the [1. SQZ] has elapsed, the **<Monitoring contact>**is scanned. It signals to the weld timer that the electrodes are closed. The +24VDC signal at the input is linked by a logic AND with the **<Pressure input>** and is a condition for the start of the [SQZ], refer to pressure input, section 7.1.2.

> ⚠ **CAUTION!**
>
> When the **<Monitoring contact>** has been permanently connected to +24 VDC, the [squeeze times] should be selected long enough so as to ensure that the parts to be welded are optimally squeezed together before the beginning of the [weld times].

7.3.2   Parallel outputs

<Control ready>

The **<Control ready>** signal indicates the ready status of the weld timer. In parallel, the green LED ⇑ on the font panel is lighted. This signal is canceled in the event of a fault, e.g. with:

-    E-STOP circuit open

-    a fault in the [Sequence] or an inadmissible deviation of a monitored value which has been defined as a fault in the *Fault Allocation* in the *Basic-Setup* menu

-    a battery fault that has been defined as a fault in the *Fault Allocation* in the *Basic-Setup* menu*,* etc.
     Page 11-3: Messages concerning the timer status,
     page 11-4: Messages concerning *current monitoring*

┌─ **NOTE** ────────────────────────────────────┐

The programming terminal signals the cause of the fault in the Timer-Status-Message window. Detailed information is displayed by calling up diagnostics for I/Os or timer diagnostics.

When the cause of the fault has been cleared, the ready state is restored by:

-    the **<Reset Fault with WC>** signal, please refer to page 7-22

-    an operation in the BOS-5000 software, e.g. in the *Diagnostics -Timer* window or

-    the green button on the front panel of the PSI 6XXX.190 W1.

<Weld/No weld>

If the sum of all firing settings (logical AND operation, see below) is switched on when a basic program number is selected, the **<Weld/No weld>** signal is output.

- **<Weld/No weld>** signal ON:
  All firing settings for the selected program of the timer are active. The [Sequence] is performed with welding current.

- **<Weld/No weld>** signal OFF:
  One of the firing settings is inactive, or no basic program number has been selected. The [Sequence] is performed without welding current.

If firing has been switched off externally, a timer status message is displayed at the programming terminal.

Firing settings:

- **<Weld/No weld external>**

- Programming of weld/no weld internal for all programs in the menu *Programming - Basic Setup - Sequence-Setup.*

- Programming of program-related weld/no weld for one program in the menu *Programming - Basic Setup - Sequence-Setup.*

For all timers		Program-related firing	Program-related sequence
External weld	Weld internal		
off	off	off	Sequence **without** welding current
off	off	on	Sequence **without** welding current
off	on	off	Sequence **without** welding current
off	on	on	Sequence **without** welding current
on	off	off	Sequence **without** welding current
on	off	on	Sequence **without** welding current
on	on	off	Sequence **without** [1] welding current
on	on	on	Sequence **w i t h** welding current
[1] Caution: Program-related firing may be active for other programs			

Figure 23: Firing settings

<Without monitoring>

This signal indicates that welding is performed without *current monitoring*.

If *current monitoring* is switched off, deviations from the tolerance band in *current monitoring* are not detected.

NOTE

When current monitoring has been deactivated, you should always check the quality of your welds.

Current monitoring	Monitoring **stopped** for all timers	Current monitoring function
off	on	on: **without** current monitoring
off	off	on: **without** current monitoring
on	on	on: **without** current monitoring
on	off	off: **with** current monitoring

Figure 24: Current monitoring

NOTE

Monitoring stopped is activated and deactivated for all timers (for all programs of the selected timer) in the Basic-Setup, in the menu Sequence-Setup.
Current monitoring is activated and deactivated for specific programs with the Welding Parameters option in the Current-Monitoring window.

<Solenoid>

A +24 VDC signal for driving a solenoid valve (max. 1 A) is available at the output. The output is protected by a separate miniature fuse.

The output carries +24 VDC from the beginning of the [1.SQZ] until the end of [HLD].

<Weld complete> (WC)

When **<Start>** has been cleared, the **<Weld complete>** signal is output for the pro-grammed duration in milliseconds.

This signal serves as an acknowledgement for peripheral devices (e.g. robot control). In seam mode the signal reports a faultless weld at the end of the seam.
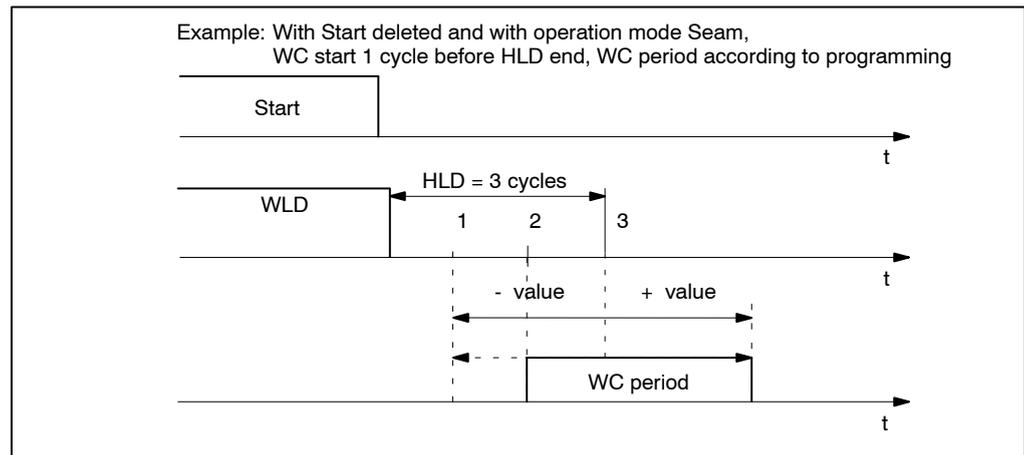

Example: With Start deleted and with operation mode Seam,
WC start 1 cycle before HLD end, WC period according to programming

Start

t

HLD = 3 cycles

WLD   1   2   3

t

- value   + value

WC period

t

Figure 25: Example on Programming of the Weld complete contact WC

Output of the **<Weld complete>** signal is possible even if the weld was not performed correctly by appropriate programming in the *Basic-Setup*, menu item *I/O Parameters*.

The **<Weld complete>** signal may be output manually in the *Diagnostics - Simulate* menu in *Operation*.

<Welding fault>

This signal is output in the event of a fault in the [Sequence] or if the timer recognizes an inadmissible deviation of a monitored value which has been defined as a fault. The ready state of the timer is cleared. Any further [Sequence] is disabled until the correction of the fault has been signaled to the timer.

When the cause of the fault has been cleared, the ready state is restored by:

- the **<Reset Fault with WC>** signal, please refer to page 7-22, or

- an operation in the BOS-5000 software, e.g. in the *Diagnostics -Timer* window or

- the green button on the front panel of PSI 6XXX.190 W1.

Also refer to **<Control ready>** signal, page 7-23.

The **<Welding fault>** output is signaled when a fault has occurred in the seam. The [schedule] is not interrupted.
At the end of the schedule, opening the **<Start>** after a welding fault will clear the **<Control ready>** signal and status.
The welding fault has to be reset before the next seam can be welded.

NOTE

A failure is defined as a fault in the Fault Allocation feature in the Basic-Setup menu.
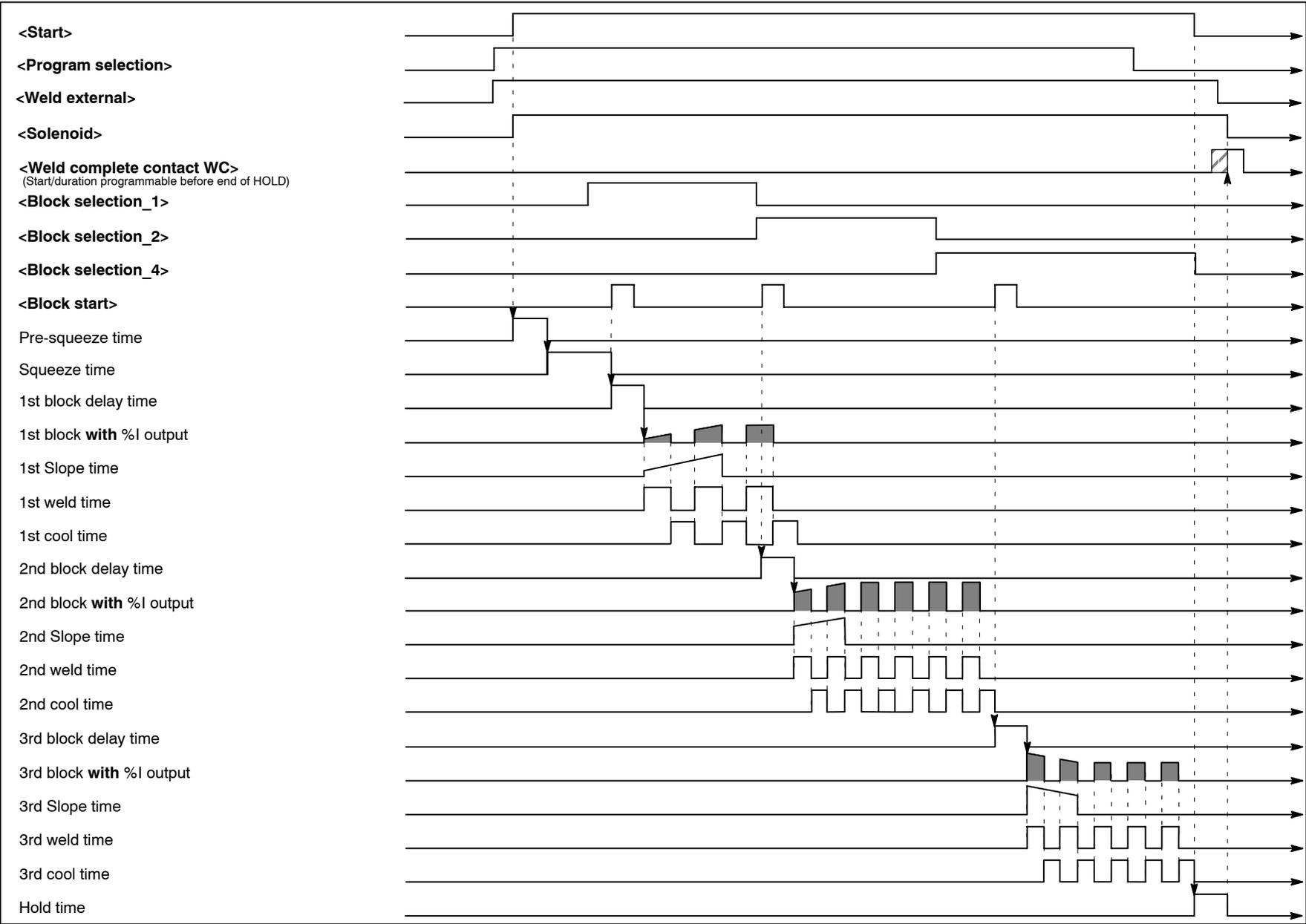
Your notes:

8 Control diagrams

Control diagrams

PSI 6XXX.190 W1

BOSCH

<Start>

<Program selection>

<Weld external>

<Solenoid>

<Weld complete contact WC>
(Start/duration programmable before end of HOLD)

<Block selection_1>

<Block selection_2>

<Block selection_4>

<Block start>

Pre-squeeze time

Squeeze time

1st block delay time

1st block **with** %I output

1st Slope time

1st weld time

1st cool time

2nd block delay time

2nd block **with** %I output

2nd Slope time

2nd weld time

2nd cool time

3rd block delay time

3rd block **with** %I output

3rd Slope time

3rd weld time

3rd cool time

Hold time

Figure 26: Example of a normal schedule (sequence) with weld on, seam with 3 block programs

<Start>

<Program selection>

<Weld external>

<Solenoid>

<Weld complete contact WC>
(Start/duration programmable before end of HOLD)

<Block selection_1>

<Block selection_2>

<Block selection_4>

<Block start>

Pre-squeeze time

Squeeze time

1st block delay time

1st block **with** %I output

1st Slope time

1st weld time

1st cool time

2nd block delay time

2nd block **with** %I output

2nd Slope time

2nd weld time

2nd cool time

3rd block delay time

3rd block **with** %I output

3rd Slope time

3rd weld time

3rd cool time

Hold time
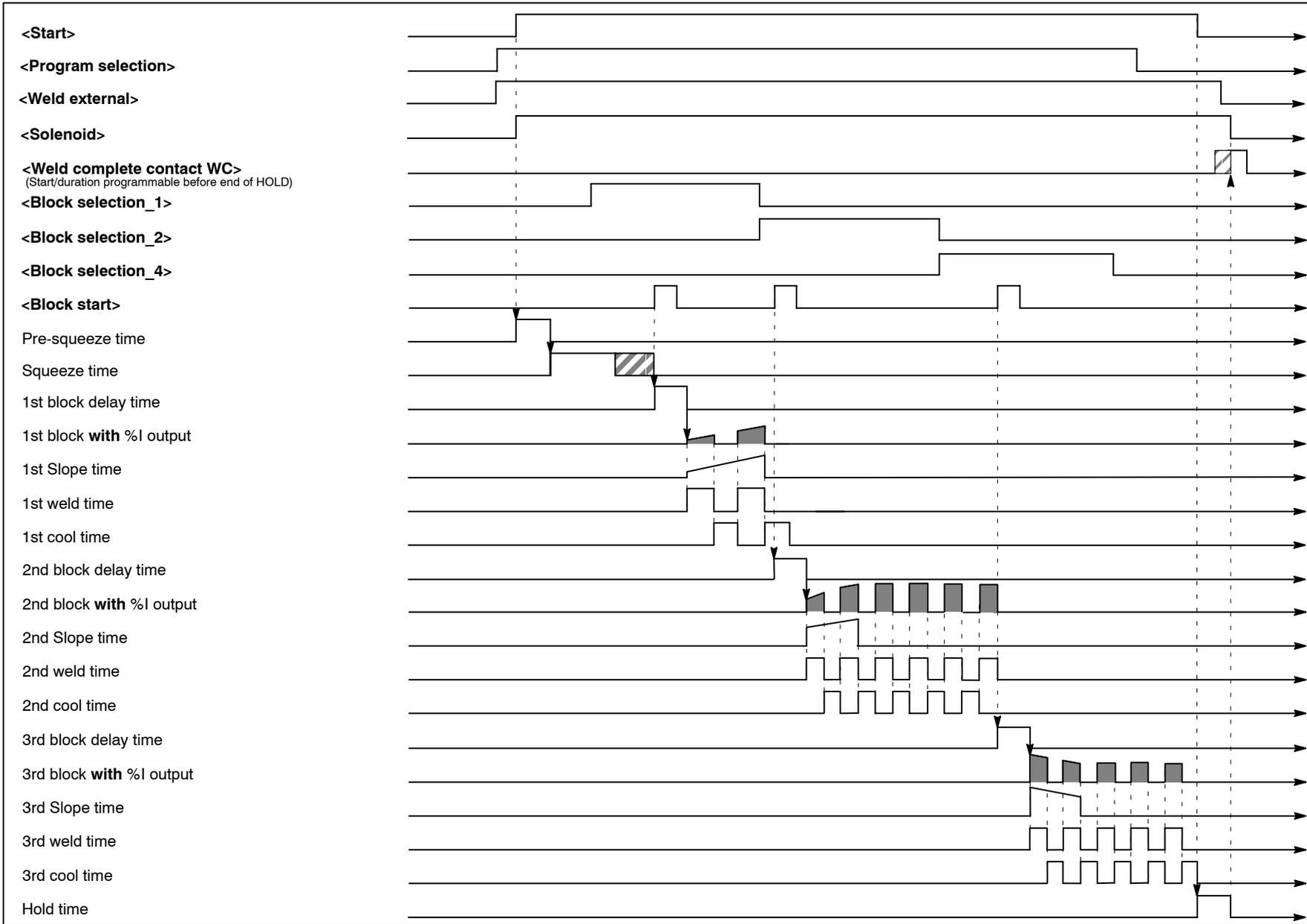
Figure 27: Example of a schedule (sequence) with delayed start of block, seam with 3 block programs

Control diagrams

PSI 6XXX.190 W1

BOSCH

<Start>

<Program selection>

<Weld external>

<Solenoid>

<Weld complete contact WC>
(Start/duration programmable before end of HOLD)

<Block selection_1>

<Block selection_2>

<Block selection_4>

<Block start>

Pre-squeeze time

Squeeze time

1st block delay time

1st block **without** %I output

1st Slope time

1st weld time

1st cool time

2nd block delay time

2nd block **without** %I output

2nd Slope time

2nd weld time

2nd cool time

3rd block delay time

3rd block **without** %I output

3rd Slope time

3rd weld time

3rd cool time

Hold time

Figure 28: Example of a normal schedule (sequence) with No weld on, seam with 3 block programs

Ⓤ

BOSCH

PSI 6XXX.190 W1

Control diagrams

<Start>

<Program selection>   no meaning

<Weld external>   no meaning

<Solenoid>

<Weld complete contact WC>
(Start/duration programmable before end of HOLD)

<Block selection_1>

<Block selection_2>

<Block selection_4>

<Block start>

Pre-squeeze time

Squeeze time

1st block delay time

2nd block **without** %I output

1st Slope time

1st weld time

1st cool time

2nd block delay time

2nd block **without** %I output

2nd Slope time

2nd weld time

2nd cool time

3rd block delay time

3rd block **without** %I output

3rd Slope time

3rd weld time

3rd cool time

Hold time

Figure 29: Example of sequence cancellation during squeeze times (1.SQZ, SQZ)

9 BOS-5000

The seam welding timer PSI 6XXX.190 W1 has 32 seam programs each of which is composed of a basic program and 7 related block programs, refer to section 7.3.1.

The higher-level welding parameters are to be programmed in the basic programs. The welding parameters for the current blocks, which are required for the [schedule], are programmed in the block programs.

9.1 Programming the *Basic-Setup*

Generally for all seam programs:

Safe Delete (Delete Memory)

Safe Delete (Delete Memory)

Fault-Allocation

Fault-Allocation for faults of the 2nd Weld time [2. WLD]

I/O Parameters

Weld complete (WC)

Thyristor (Power) Unit Setup

Power unit parameters

Weld Transformer Selection

Weld transformer type

Electrode (Stepper) Setup

%I Limitation
%I Prewarning
Upper Current Limit
Maximum Pressure
Conversion Factor
Zero Adjustment

Sequence Setup

Start inhibit	
Weld/No Weld	
Max. Welding Time	
Monitoring stopped	
Fade-out time	
Trail current	
Measurement Circuit Test (Measurement Loop Check)	
Current measurement	fixed on primary side
Program-specific start inhibit	
Electrode number	fixed 0
Program-specific weld/no weld	
Schedule - Welding modes	fixed seam
Regulation	fixed mixed
Monitoring	
Spot-Repeat	fixed Off

Other windows in the *Basic-Setup* window

The *Basic-Setup* of the seam welding timer is performed without the *Basic-Setup* of the following windows. A programmed *Basic-Setup* of these windows will not be used.

- *Global Stepper-Setup*
- *Tipdress curves*
- *Stepper-Curves*

9.2   Programming the *Welding Parameters*

Dividing the *Welding Parameters* of a seam program between the basic program and the block programs:

  x: the *Welding Parameters* are programmed in a basic or block program designated with an x

  -: the *Welding Parameters* in the basic or block program are not used.

Schedule (Sequence)

Welding Parameters	Basic program	Block program
Slope on / off	x	x
Pre-Squeeze Time [1.SQZ]	x	-
Squeeze Time [SQZ]	x	-
Block delay time [BDT] as Pre-Squeeze Time [1. SQZ]	-	x
1st Weld Time [1. WLD] with %I and Regulation Mode	-	-
1st Cool Time [1. CT]	-	-
Up Slope Time [UST]	-	x
2nd Weld Time [2. WLD] with %I and Regulation Mode	-	x
Down Slope Time [DST] with %I	-	-
2nd Cool Time [2. CT]	-	x
3rd Cool Time [3. CT]	-	-
3rd Weld Time [3. WLD] with %I and Regulation Mode	-	-
Hold Time [HLD]	x	-
OFF Time [OFF]	-	-
Impulse	-	-

Current Monitoring

Parameters	Basic program	Block program
Standard Monitoring mode	-	-
Monitoring Parameters Mixed 1st Weld time [1. WLD]	-	-
Monitoring Parameters Mixed 2nd Weld time [2. WLD]	-	x
Monitoring Parameters Mixed 3rd Weld time [3. WLD]	-	-

Pressure

Parameters	Basic program	Block program
Base-Pressure	x	-
Pressure Profile	-	-
Pressure values for the pressure profile	-	-

Other windows in the *Welding Parameters* menu

A seam weld is programmed without the *Welding Parameters* of the following windows. Programmed *Welding Parameters* contained in these windows are not used.

- *Stepper*
- *Time-Monitoring*
- *Monitor-Stepper*
- *Pressure-Stepper*
- *Freely Programmable Outputs*

9.3 Input ranges of the Welding Parameters

- Pre-Squeeze Time : 0 to 2000 ms

- Squeeze Time : 16 to 2000 ms

- 1st to 7th Block delay time : 0 to 2000 ms
  (as Pre-Squeeze Time [1. SQZ] in the block programs)

- 1st to 7th Current slope time : 0 to 2000 ms

- 1st to 7th Weld time : 1 to 2000 ms

- 1st to 7th Cool Time : 0 to 2000 ms

- 1st to 7th Regulation mode : PHA or KSR

- 1st to 7th %I KSR : depends on the welding transformer used

- 1st to 7th %I PHA : 0 to 100 SKT

- Hold Time : 1 to 2000 ms

9.4   Determining the actual values

Outside the slope times, an actual value is calculated at the end of each current impulse (WLD + CT). Depending on the fade-out time and mode with/without current monitoring, the aggregate of the current measured is divided by the number of measured half-cycles and regarded as the actual current for this impulse. This actual impulse current is used for monitoring.

In parallel, an actual phase angle is formed for the impulse. This angle is always calculated without a trail current.

At the end of a [sequence], a mean value is calculated from the last 16 impulse currents and impulse phase angles, which is formed separately for each current block. This mean value is memorized as the actual current or actual phase value for the respective current block and displayed on the BOS-5000 operator interface.

The mean value can be defined as the monitoring value with the **<Act ->Com>** command button on the operator interface.

9.5   Current monitoring in the block programs

For each current block programmed in a block program, which consists of the 2nd Weld time [2. WLD] , an upper and lower tolerance band and as well as a monitoring current value can be programmed.

Each current block is monitored separately, and monitoring can be individually activated and deactivated for each current block.

If monitoring has been activated for a current block, the actual impulse current is compared to the monitoring value, evaluated and memorized outside the slope times [UST] and [DST] at the end of each current impulse.

At the end of the seam, the result of the individual weld times is evaluated, and a fault message is displayed, if necessary.

NOTE

In a seam welding system, a system-specific upslope takes place at the beginning of each weld time.
In order to avoid fault messages arising from this upslope when monitoring is active, this system-specific upslope time should be suppressed for current measurement using the fade-out time parameter.

10　　Commissioning

> **NOTE**
>
> *For commissioning, please note the safety instructions, the technical data and the electrical wiring diagrams.*
> *The following sections contain suggestions on how to proceed during commissioning. Acceptance of these suggestions will depend on the specific circumstances and will be the responsibility of the commissioning personnel.*
> *Concerning the status messages of the timers, please refer to the BOS-5000 software and to section 11, Messages.*

The following components are necessary for commissioning:

- programming terminal with V24 interface and Windows operating system, suitable interface boards in the programming terminal and the weld timers if field bus installations are used.

- BOS-5000 software

- V24 interface cable, cf. section 7.1.1, suitable field bus cables for field bus installations.

Communication between the programming terminal and the timers is via the V24 or field bus interfaces (e.g. Profibus). In Online mode, all *Welding Parameters* are saved to the timer.
Saving the *Welding Parameters* in the programming terminal for preparative commissioning (offline timer) is possible.

● The BOS-5000 software must be switched to online mode, and the terminal must be connected to the timer or the networked timers.
Conditions:
- *Timer Reference* has been performed.

For more information on these issues, please refer to the following documentation brochures:

- Operating and Programming Manual BOS-5000, volume 1, part no. 1070 078 217

- Operating and Programming Manual BOS-5000, volume 2, part no. 1070 078 218

> **NOTE**
>
> *If Welding Parameters have already been programmed into the timer, you should first save these parameters with the Upload (Backup) function.*
> *Select Operation - Services - Upload (Backup).*

10.1   Preparations

- Connect and turn on the timer according to the wiring diagrams and safety instructions.

- Deactivate the **<Weld external>** signal for as long as you do not need any welding current for commissioning.

- Start the BOS-5000 software and enter your user group and user password.

- Select *Operation*.

- Check in the plant layout whether there is a link (V24 -> timer or field bus interface board -> timer) between the programming terminal and the timer.
  - If the timer is not linked to the programming terminal (gray timer symbol in plant layout), check the connection cable or the address settings (with Profibus installations, also check the circuitry of the terminating resistors), the Timer Reference and the power supply to the timers.

- Select the timer and program for commissioning in the BOS-5000 software.

10.2   Testing the welding program

A welding program can be executed with or without firing (with or without welding current). For this purpose, weld internal or the weld external function can be turned on or off. In a [Sequence] without welding current, for example, one can first examine the I/O signal exchange with the higher-level control unit and the positioning of robot electrode guns.

●   Select welding program.

⚠   **CAUTION!**

Before you start:
Always make sure beforehand that there is no person in the danger zone of the robot's electrode gun.

●   Start the welding program.
       The following signals must be present for the Start:

     -      Monitoring contact (MC)
     -      Pressure input at connector X2

☞   **NOTE**

If the sequence is not completed, or if it is aborted, messages will be displayed in the Operation - Diagnostics - I/Os or Timer window.

10.2.1   Suggestions for a welding test

- Check whether the power unit type used has been programmed in *Basic-Setup - Thyristor (Power) Unit Setup*, and change it if necessary.

- Perform the first test weld without firing (*Weld/No weld internal* "off" or **<Weld external>** "off").

- Then change to *Quick-Programming* and enter the following test parameters:

Parameters	Setting	Programming in
Start Inhibit (T)	off	Basic program
Weld/No weld internal (T)	off	
Control Stopped	on	
Start Inhibit (P)	off	
Weld/No weld internal (P)	off	
Sequence	Seam	
Regulation	Mixed	
Regulation Mode	Phase angle	
Slope	off	Block program
Pre-Squeeze Time [1. SQZ]	60 milliseconds	Basic program
Squeeze Time [SQZ]	350 milliseconds	
Block delay time [BDT]	60 milliseconds	Block program
2nd Weld Time [2. WLD]	100 milliseconds	Block program
Hold Time [HLD]	100 milliseconds	Basic program

- Check whether the welding cycle is carried out.

- Perform more test welds with firing (*Weld/No weld internal* "on" and **<Weld external>** "on")

- Change the weld times, %I, etc. for the parts to be welded.

10.3   *Basic-Setup*

If the timer has already been programmed, the *Quick-Programming* will give you a good overview of the most important *Welding Parameters*.

● Use function key F9 to change from *Operation* to *Programming*.

● Check the *Basic-Setup* of all programs used.
  - *Safe Delete (Delete Memory)*
  ● Find out whether the protocol memories, Actual values and Welding Parameters can be deleted.
    After deletion, the timer will use default values for as long as you have not transferred any other *Basic-Setup* and *Welding Parameters*.

NOTE

The "All Welding Parameters" memory area contains the entire programming. If you delete this memory, all Welding parameters have to be transferred again.

  - *Fault-Allocation*
    Used to determine the timer response to events within the [Sequence].
    - Fault   : Timer will lose its ready status.
    - Warning   : Timer will not lose its ready status.
  - *Thyristor (Power) Unit Setup/Weld Transformer Selection*
  ● Compare the entries and settings to your network data and the power unit used.
  - *Global Electrode (Stepper) Setup*
    Stop at End of Stepper and admissible correction limits for subsequent Operation.
    These settings can be entered when commissioning has been completed.

- *Electrode Setup*

● Check the *Electrode Setup* or adjust it to the hardware components of your welding equipment.
  The input concerning the toroid sensitivity and the [Pressure] should be adjusted to the real conditions later on by performing the *Scaling* procedure.

- *Sequence Setup*

Suggestion concerning the settings for all programs:

● Deactivate Start Inhibit.
  Firing setting depending on the requirements of the commissioning work (with/without welding current).

⚠ **CAUTION!**

When Weld external has been activated and Weld internal has been switched on, [Sequences] can be performed with welding current.

● Check and/or adjust maximum Weld Times.

● Deactivate Control Stopped for KSR mode.

Suggestion concerning the settings for the selected program:

● Deactivate Start Inhibit.

☞ **NOTE**

When working with several comparable weld timers, you should perform an Upload (Backup) for the Basic-Setup and transfer this data later on to the other weld timers using the Download (Restore) function.

10.4　　*Welding Parameters*

If the timer has already been programmed, the *Quick-Programming* will give you a good overview of the most important *Welding Parameters*.

● 　Use function key F9 to change from *Operation* to *Programming*.

● 　Check the *Welding Parameters* of all programs used.
-　　*Sequence*

● 　Check the sequence parameters, in particular, the [Weld Times] and the [%I] values (%I or kA).

-　　*Current Monitoring*

● 　Turn *Current Monitoring* on. For as long as you do not know the real conditions, you should use fairly large tolerances initially.

NOTE

For the subsequent production process, you should define smaller tolerances for monitoring in order to assure the quality of your products.

-　　*Pressure*
　　Recommendation: You should first use a simple [Sequence] without *Pressure*. These values can be programmed towards the end of commissioning.

10.5   Scaling process

For quality assurance, you should adjust your welding equipment to your real conditions by means of *Scaling*.

The following parameters will be adjusted through *Scaling*:

- toroid sensitivity

- conversion factor for pressure output

- zero shift for pressure output

● Select, e.g., *Starting Window - Scaling*.

10.6   Adjusting the program to your welding task

● Check the quality of your spot welds.

The actual current values of the spots welded are displayed in various windows, e.g. in the *Programming - Sequence - Actual Values* window.

● If necessary, adjust the following programmed values to your requirements:

- [%I] and [Weld Time]

- Type and number of [Weld Times]

- Current upslope and downslope times [Slope]

10.7   Activating monitoring

For quality assurance, *Current Monitoring* should always be switched on, and the appropriate tolerance bands should be entered.
The Actual Values are displayed and can be accepted as setpoints.

●   Activating monitoring
Select *Programming - Basic-Setup - Sequence Setup.*

●   Enter *Current Monitoring* and the tolerance band
Select *Programming - Welding Parameters - Current Monitoring.*
To facilitate the definition of the reference current and tolerance band, this window shows an *Actual value* display.

10.8   Other adjustments and programs

When commissioning has been completed, you may protect access to the BOS-5000 software in order to restrict changing the *Welding Parameters* and the *Basic-Setup* by defining user levels. A systems disk is needed for this purpose.

●   Use the *BOS-5000 Set-up* in the *System* menu for this purpose.

Other adjustments:

●   Maximum admissible limits for [%I] and [Pressure] correction by the user.

●   Regulation and monitoring mode

Other programs with slightly different parameters can be generated by copying.

●   Copying programs:
Select *Operation - Services - Copy.*

10.9   Saving the Welding Parameters

When commissioning has been completed, you should backup your programs with the *Upload (Backup)* function.

● Create *Upload (Backup)*:
Select *Operation - Services - Upload (Backup).*

> **NOTE**
>
> *Existing Upload (Backup) files will be replaced. You may enter a new file name for the new Upload (Backup) file using the File Reference function.*

When the *Upload (Backup)* has been completed, we recommend using the *Compare* function in order to check whether the saved *Welding Parameters* and *Basic-Setup* are identical with the timer values.

● Performing *Compare*:
Select *Operation - Services - Compare: File -> Timer.*

> **NOTE**
>
> *When using the Compare function, you should always make sure that you selected the proper timer and restore data.*

11 Messages

11.1 Fault and Status Messages

Messages

- **Warnings** : The ready status of the timer remains, further [sequences] are not inhibited.
- **Faults** : The timer is no longer ready, further [sequences] are inhibited.

> ☞ **NOTE**
>
> *Internally the timer works with coded numbers. All messages are output on the programming unit in text format.*

Fault messages and warnings for *Current Prewarning* and *Maximum %I* are cleared with every new program start.

11.2   Ranges of Messages

[A]   Messages concerning the connection WT → Programming terminal
(communication messages)

[B]   Messages concerning the stepper (electrode) status
(Pre*warning*, *End of Stepper reached*, etc.).

[C]   Messages concerning the timer status
(*battery low*, no +24V etc.).

[D]   Messages from active monitoring (*Weld-time exceeded*).

11.2.1   [A] - Communication Messages

Code	Explanation
-93	
-94	
-95	
-96	*Communication with weld timer cannot be established*
-97	*Communication with weld timer was disconnected*
-98	*Upload or Download active in Timer*
-99	*Objects are not accessible*
-100	*Incorrect timer type (wrong timer in Ref. Table)*
-146	*Fatal error layer 8*
	Error when starting the status message (possibly not enough RAM memory. Close other applications).
-193	*Error during checking of parameters*
-194	*Timer name is unknown*
-195	*Timer is unknown*
-196	*Driver is not installed*
-197	*Station does not exist or driver is not loaded*
-198	*Object does not exist*
-199	*Service is unknown*
-200	*Error of calling parameters*

11.2.2 [B] - Electrode (Stepper) Messages

Code	Explanation	Additional code
40*	*%I (Current) Prewarning*	Electrode no.
41*	*Maximum current*	Electrode no.

11.2.3 [C] - Messages Concerning the Timer Status

Code	Explanation	Additional code
80	*Stop Open circuit / no +24V*	-
83	*Thyristor unit not ready*	-
84	*Battery low*	-
85	*Memory deleted = RAM checksum error*	-
86	*Data Restore active*	-
87	*No weld program = invalid parameter*	Program no.
88	*Hardware fault*	H/W fault bitcode
93	*Synchronization fault*	-
94	*Sequence inhibited*	Program no.
99	*Welding process*, cf. [D]	Monitoring code
100	*Supply voltage fault*	-
102	*No weld external*	-
103	*No weld internal*	-

11.2.4   [D] - Messages for Current Monitoring

Code	Explanation
1011 to 1017	*No current* (mixed mode) block 1 to 7
1021 to 1027	*Current too low* (mixed mode) block 1 to 7
1031 to 1037	*Current too high* (mixed mode) block 1 to 7
1051 to 1057	*Current measuring range exceeded* (mixed mode) block 1 to 7

12   Maintenance

> **WARNING!**
>
> -   Danger of life through electrical voltage!
>   Prior to any maintenance work - unless described otherwise - the system must always be switched off! If the system had been active shortly before, wait until the system is totally de-energized before starting the maintenance work (e.g. because of charged capacitors, etc.). For the duration of the maintenance work the system must always be protected against re-closing.
>   In the event of necessary measurement or test procedures at 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-STOP facilities!
>   EMERGENCY-STOP facilities must be operative in all modes of the system. Releasing the EMERGENCY-STOP facility must by no means result in an uncontrolled restart of the system!

> **CAUTION!**
>
> -   The right to perform repair/maintenance work on the timer components 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.

The connections and termination points of all connecting cables must be checked in regular intervals for firm sit. Check all cables for damages.

12.1   Changing batteries

> **NOTE**
>
> *Data buffering is assured for about 30 hours, without internal or external 24 VDC supply voltage and after removing the battery.*

A 3.6 V Lithium battery is installed in the PSI 6XXX.190 W1 to provide data backup power. This battery supplies the RAM memory and the internal clock in the power down state. Battery life is approx. 2 years.

If the battery voltage drops so far, that data buffering is no longer assured, the welding timer will sense this state. The reaction to this event depends on the *Fault Allocation* in the menu *Basic Setup.*

-      If a low battery is defined as a fault, the control prevents the next start and the Ready message turns off. The [Sequence] can resume after changing the battery and resetting the fault.

-      If a low battery is defined as warning, the control will issue the appropriate message, but [Sequence] will not be disabled.

To change the battery, first remove the cover to the battery compartment with CCW motion and remove the old battery. Then insert the new battery, while observing the correct polarity (see illustration on front cover).

> **NOTE**
>
> *To prevent loss of data, a bi-annual battery change is recommended as part of preventive maintenance procedures.*

> **CAUTION!**
>
> To prevent environmental harm, observe the currently valid disposal regulations for batteries in effect.

> **CAUTION!**
>
> Danger of explosion: Never expose the battery to temperatures above 85 °C. Do not attempt to charge, solder or incinerate the battery. Do not short circuit or disassemble the battery.

13   Ordering

Spare parts

Designation	Part no.
PCB I/O level	1070 073 094

Included in shipment (STKK plug-in terminal)	Part no.
[X] please refer to section 3.2	
[10] Power supply, X4: STKK 14-pin (3.5 mm)	1070 916 914
[11] Ext. device (unit), X5: STKK 2-pin (3.5 mm)	1070 914 564
[12] no function, X8: STKK 3-pin (3.5 mm)	1070 916 798
[13] Pressure, X2: STKK 5-pin (3.5 mm)	1070 916 910
[14] Analog output, X9: STKK 6-pin (3.5 mm)	1070 916 554
[15] Measuring system, X3: STKK 8-pin (3.5 mm)	1070 916 553
[x] type-specific I/Os: please refer to section 3.3	
[2] Inputs, X13 STKK 16-pin (3.5 mm)	1070 916 795
[3] Inputs, X12 STKK 8-pin (3.5 mm)	1070 916 553
[4] Outputs, X11: STKK 14-pin (3.5 mm)	1070 916 914
[5] Power supply X10: STKK 4-pin (3.5 mm)	1070 916 908

Not included in shipment		Part no.
[X]	please refer to section 3.2	
[9]	V24, X1: 9-pin female D shell connector	1070 912 981
[9]	V24, X1: 9-pin female D shell connector housing	1070 313 723
	finished cable V24, X1: for connecting PC to timer; length 1.5 meter	1070 066 749
	shielded cable 2 x 2 x 0.75 mm^2 LiYCY	1070 913 494
[16]	Battery compartment with cover	1070 917 004
[16]	Battery	1070 914 446
[X]	please refer to section 3.3	
[1]	Fuse M 1.6 A, type 5 x 20	1070 900 844
[1]	Fuse holder with cover, type 5 x 20 FAB	1070 910 588

A   Annex

A.1   Abbreviations, Terms

2.WLD	2nd Weld time: main weld time, can consist of a block comprising individual impulses, only the 2.WLD can have upslope and downslope
BDT	Block delay time, time between block start and first %I impulse
CT COOL	Cool time: time between the current pulses/blocks (1., 2., 3. COOL (CT))
Current	Current measured in %I (scale units) or kA (same as HEAT).
DST	Down Slope Time: until the end of 2. WT current is reduced gradually.
EA (EO)	Electronic output: in this case +24V through transistor
EOS	End-of-Sequence contact: signal is output when the spot has been completed
Ext	External, e.g. +24V: voltages for signal transmitters (switches) and actuators (valves) external to the timer
Firing (Ignition)	Weld on/Weld off: enabling and disabling of the firing (ignition) impulses for activating the power unit.
HEAT	Heat in %Ht or kA (same as current)
HLD HOLD	Hold time: last time of the welding schedule; time following the last weld time, during which the parts just welded are allowed to cool down
HSA	Main switch trip
IMP	Number of pulses forming the 2.WLD
LT	Power Unit (thyristor or inverter)
NBS	Mains load limitation control: for monitoring and influencing the mains load
OFF	Off time: time between 2 spot welds during which the solenoid valve is not activated. Available only in REPEAT mode.
PG	Programming unit/welding computer
Post-Heating Time	Also called 3. WLD.
Pressure (Monitor) Contact (MC)	Monitor Contact: e.g. monitoring of the pressure in the cylinder that closes the electrodes, or monitoring of the electrode position; gun closed.
PSG	Transformer rectifier unit for the PSU inverter
PSI	Inverter power unit (1000 Hz)
PSL	PS power unit
PSP	PS programming module
PSS	PS timer
PST	Thyristor power unit (50/60 Hz)
PSU	Weld current inverter (medium frequency)
RA (RO)	Relay output, +24V are output via a contact
REPEAT	Repeat mode: for manually operated systems only

SING	Single spot mode for automatic welding machines and manual systems
Slope	Current increase (or decrease) from an initial to a final current.
Solenoid valve	Activates the cylinders to close the electrodes.
SQZ	Squeeze time that elapses before the weld time. The electrodes squeeze the parts to be welded together.
Stepper	Current (heat) stepping for compensating for electrode wear
Temp	Temperature
UST	Upslope Time; time during which the Current (HEAT) stops after beginning of 2.WLD
WC	Weld Complete contact: signal is output when the spot has been completed
WLD	Weld time
WT	Weld timer, also called resistance weld timer

A.2 Regulation terms

%Ht	Specification of heat in %Ht: represents the electrical phase angle (same as %I)
%I	Specification of current in %I: represents the electrical phase angle (same as %Ht)
kA	kilo Amperes
KSR	Constant current regulation: the current in the secondary circuit is maintained constant by regulation
KUR	Constant voltage regulation: compensation for mains voltage fluctuations
PHA	Phase angle (shift) regulation
SKT (SKV)	Scale Units; correspond to an electrical phase angle.

A.3 Index

Your notes: