PST 6101.321 / PSI 6101.321
Technical Information

Edition 101

PSX 6000 Description of Timer and I/O Level

PST 6101.321 / PSI 6101.321
Technical Information

1070 080 056-101 (99.09) GB

DIN ISO 9001

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Contents

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Your notes:

Safety instructions and reader's information

Please read this documentation before working with the <u>W</u>eld <u>T</u>imer (WT) PSI 6101.321 / PST 6101.321 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 Machine Directive.

Nevertheless, there is some residual risk!

The contents of this manual refer to the functions of the

- timer modules PSI 6101.321 / PST 6101.321

- 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 types PSI 6101.321 / PST 6101.321.

In connection with the specified welding equipment, the weld timers type PSI 6101.321 / PST 6101.321

- **serve for resistance welding of metals**

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

The timers are 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)

- thyristor power units (PST) and/or 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**
>
> *CD's 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 6101.321 / PST 6101.321 modules is IP 20. The modules and the power unit form a single unit which must be installed simultaneously and incorporated in a housing or switch cabinet with a suitable degree of protection.
>
> -   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 6101.321 / PST 6101.321 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 inapproriate 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!
  In addition, the transformer must be labelled accordingly.

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!

- Fault reset with spot repetition
  If the start signal is present when a fault is reset with reweld (spot repetition), the timer will immediately start executing the program! This may result in dangerous machine movements! Therefore, before resetting a fault with reweld it must be ensured that nobody is in the dangerous area of the welding machine!

- 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 6101.321 / PST 6101.321 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 6101.321 / PST 6101.321 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 6101.321 / PST 6101.321 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 Timers (WT) of the PSI 6101.321 / PST 6101.321 series are suitable for spot, projection and roller seam welding, as well as for other resistance welding processes.

The welding system consists of

- Welding hardware (welding gun, robot or multi point ...)
- Timer module PSI 6101.321 / PST 6101.321
- Thyristor power unit or MF inverter
- A programming terminal for data entry, operation and monitoring
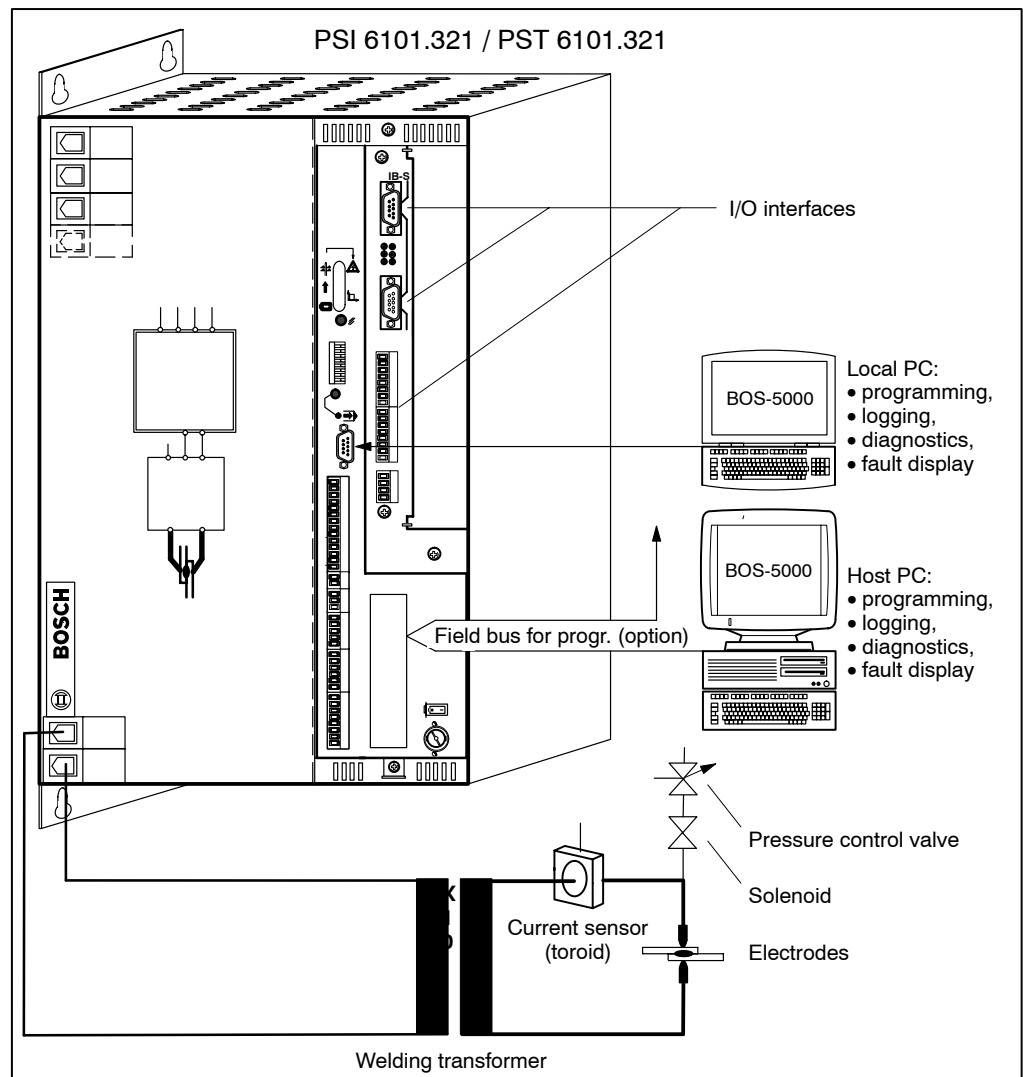
Figure 1: Welding system

Up to **256** welding programs can be programmed and called up. Single spot (SING), repeat mode (REPT) or seam operation can be selected.

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 6101.321 / PST 6101.321 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

You may choose between various weld timer types for 50/60 Hz and 1000 Hz medium-frequency applications.

Types

- PST 6000 for 50 / 60 Hz applications   : Type PST 6101.XXX

- PSI 6000 for 1000 Hz applications   : Type PSI 6101.XXX

Functional principle
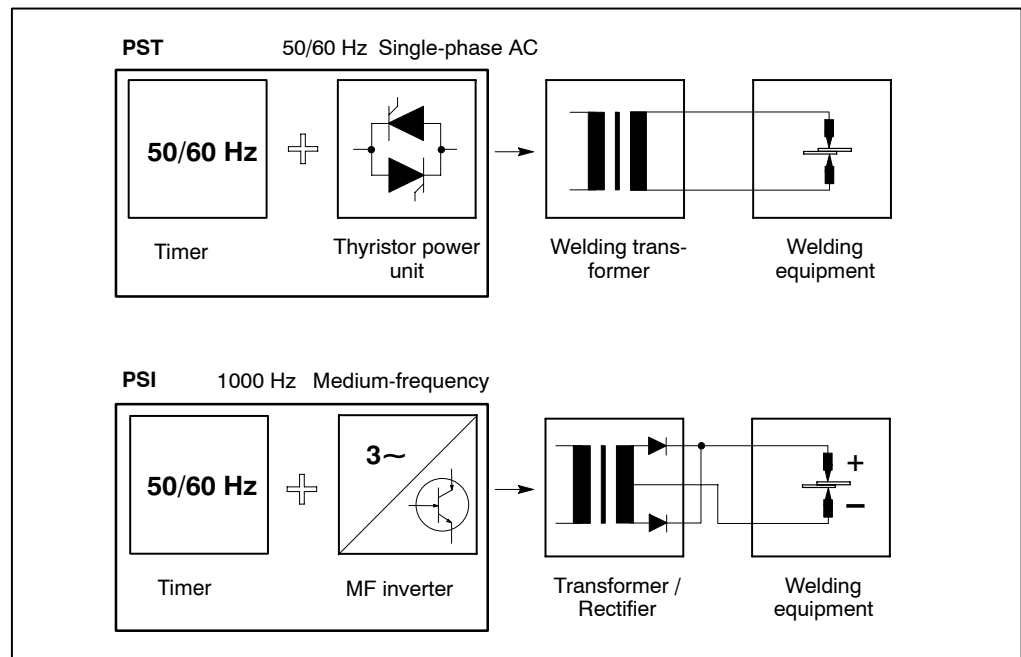
Figure 2: Block diagram of functional principle

Welding current

A 50 Hz welding system uses an AC welding current with gaps. The half-sines are set by the thyristor unit in scale values (%I) between 0 to 99, corresponding to an electrical angle of 31° to 130°.

The welding current can be controlled by the closed-loop constant-current regulation system (KSR) integrated in the weld timers.

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. 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 50/60 Hz welding.
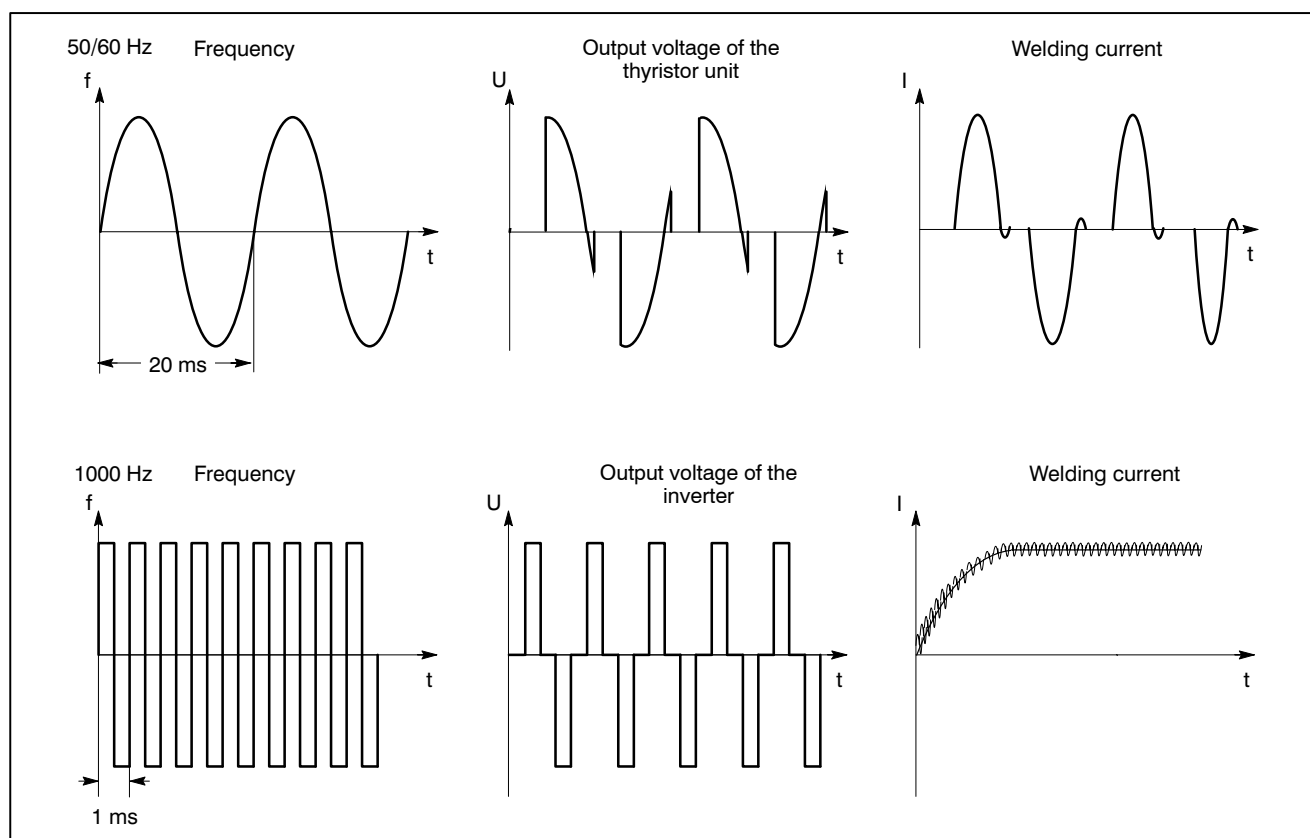
Figure 3: Comparison of 50/60 Hz and 1000 Hz welding

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.
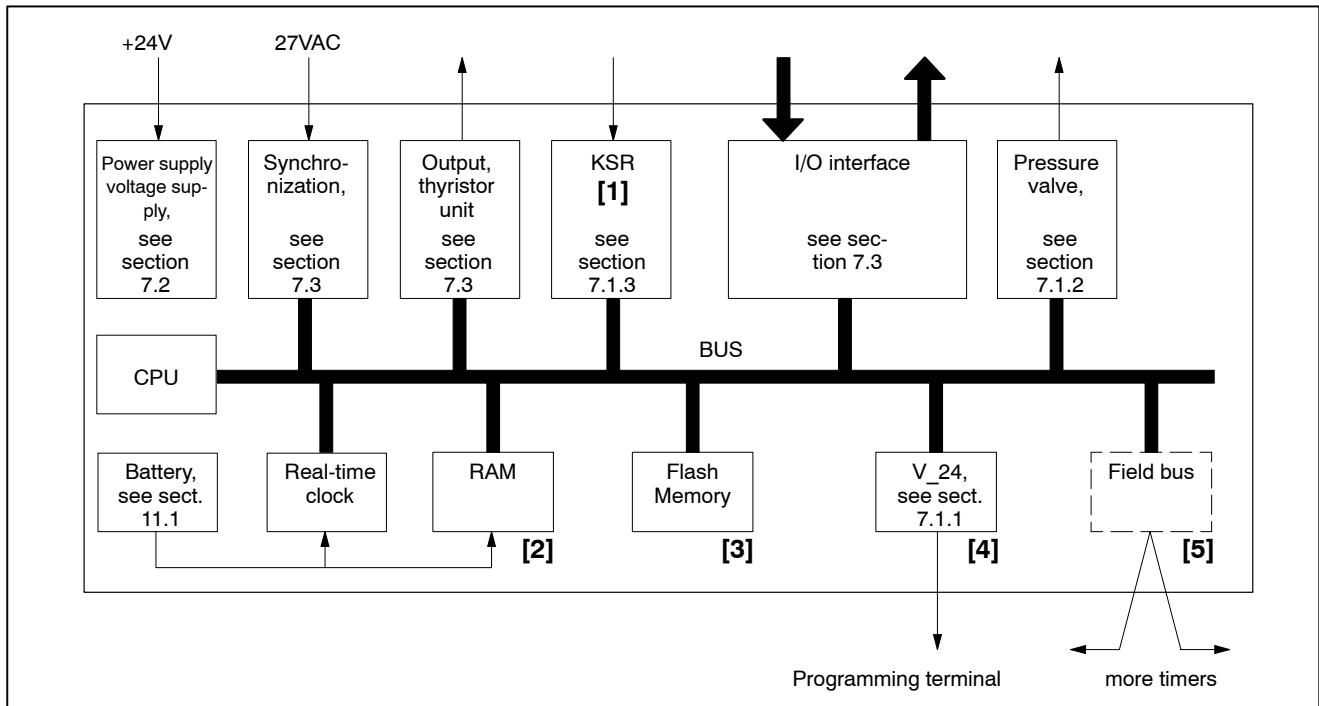
Figure 4: Block diagram of timer

[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)

1.3   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.

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/O's Note: PST 6101.321 does not offer internal supply to logic via system power, see section 7.2
Rated current (w/o I/O) 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
Weight without packaging (total weight of power unit and control unit)	PST approx. 12.5 kg PSI approx. 20.5 kg
Number of programs	256, access to each individually from program selection
Parallel inputs	+24 VDC, E0 to E7, w/o function
Parallel outputs	+24 VDC, A0 to A2, w/o function +24 VDC / max. 0.1 A, A3 to A5 +24 VDC, A6 to A7, w/o function
I/O bus	INTERBUS-S (wire)
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 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.
Output for pressure regulating valve (isolated)	analog pressure output, voltage from 0 V to +10 VDC, max. 20 mA
Stop function	via floating contact, switches off parallel I/O supply, stops schedule
KSR input	for toroid coils for current measurement

2.2   Power unit

Overview of technical data of power unit

	PST 6101.XXX	**PSI 6101.XXX L1**
System voltage	400 V -20 % to 600 V + 10 % 2-phase	400 V -20 % to 480 V +10 % 3-phase
System frequency	50 / 60 Hz	50 / 60 Hz
Clock frequency	same as system frequency	1000 Hz
DC link voltage	-	550 V DC to 680 V DC (nominal voltage)
Overvoltage protection	MOV	MOV
Temperature monitoring	integrated	integrated
Fan connection	-	integrated
max. ambient temperature (heat sink)	45 °C (without fans)	45 °C (with fans)
Nominal current (system side) (max. thermal continuous current)	130 A	110 A
Switching current	see load diagram in thyristor unit description	see load diagram in power unit description
Mains connection	U1, V1, potential earth max. 50 mm^2 frame terminals	U1, V1, W1, potential earth max. 50 mm^2 frame terminals
Transformer connection	U2, V2 max. 50 mm^2 frame terminals	U2, V2 max. 50 mm^2 frame terminals

Your notes:

3   Hardware

3.1   Structure

The PSI 6101.321 / PST 6101.321 comprises the following functional units:

-    CPU with centralized control function

-    I/O interfaces

    -    serial I/O interface (Interbus-S)

    -    parallel outputs for KSR change over

-    Quality module (slot prepared for subsequent retrofit)

-    Field bus interface optionally Profibus FMS or Interbus PMS

-    Thyristor unit AC (PST) or 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
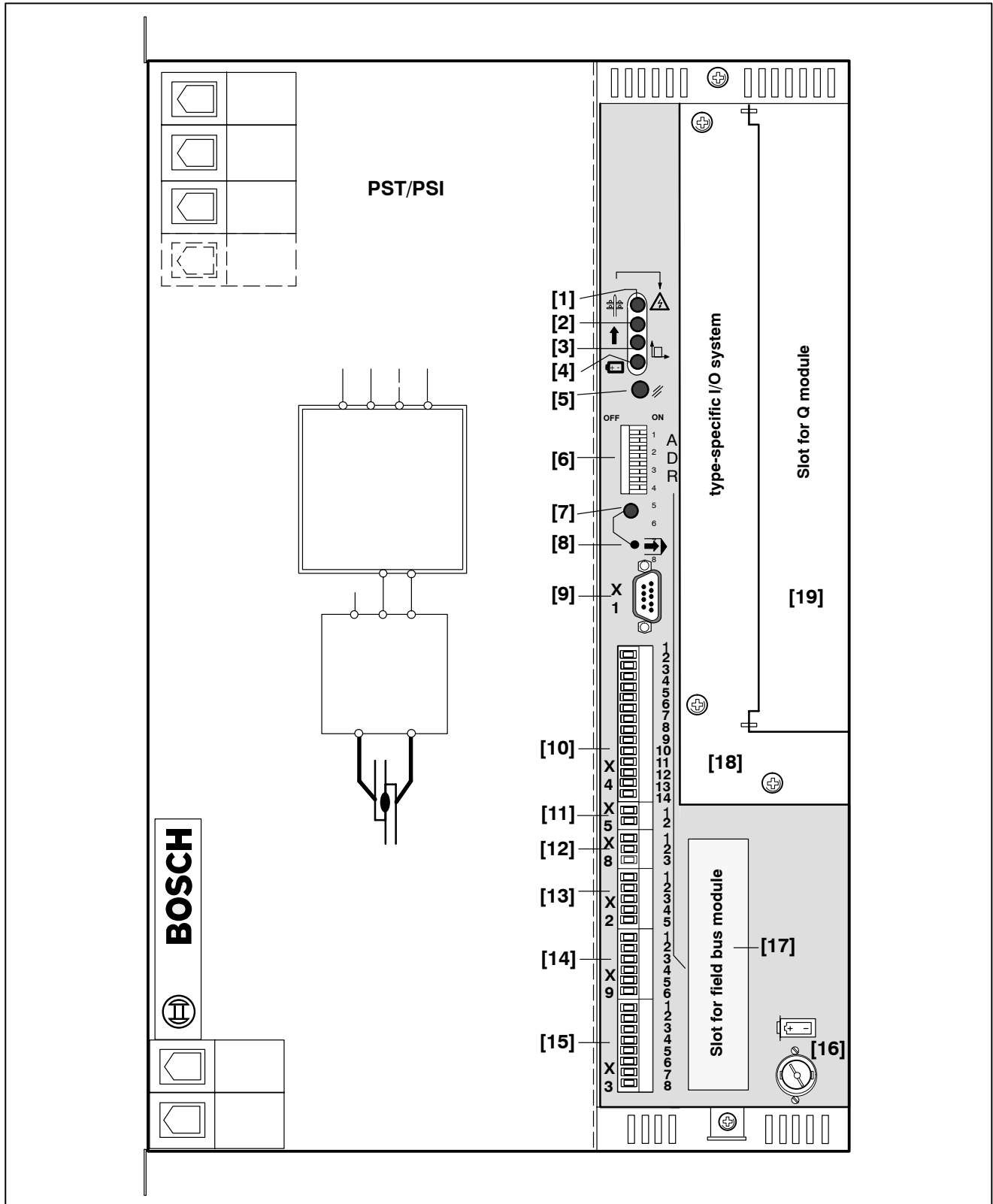
Figure 5: Front panel

[1]　Line LED, mains voltage (PST) or 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]　9-pin D shell plug, V24 interface (programming terminal).

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

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

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

[13]　5-pin plug-in terminal analog pressure output, voltage from 0 V to +10 VDC, max. 20 mA (drives pressure regulating valve).

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

[15]   8-pin plug-in terminal for measuring system, with constant current regulation (KSR) connection for current sensor (toroid).

[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 system.

[19]   Blanking plate on slot for subsequent retrofit of quality module.

3.3 Module front panel type-specific I/O's
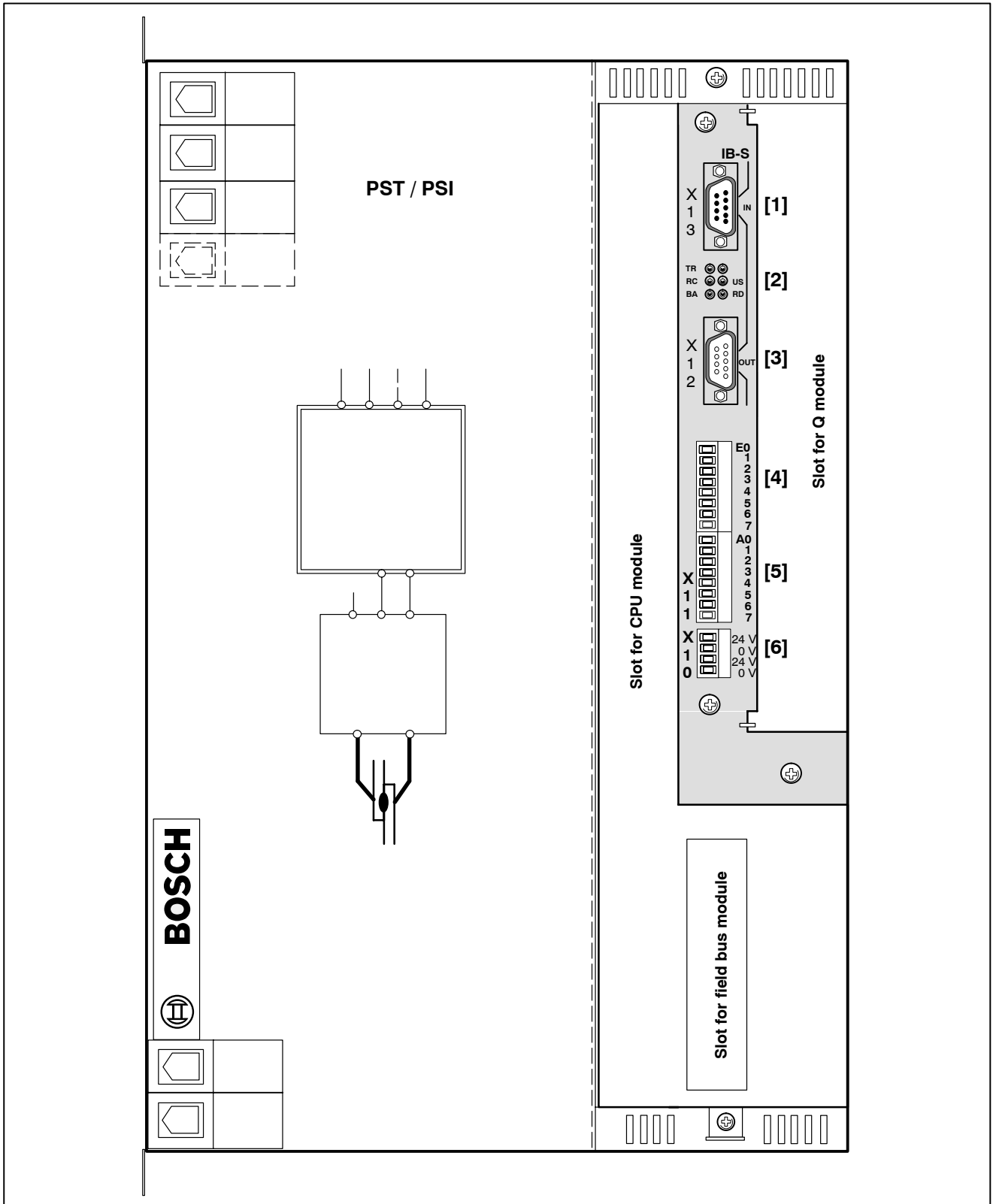
Figure 6: Type-specific I/O's

[1]   9-pin D shell plug, INTERBUS-S IN interface (remote bus interface, wire).

[2]   Diagnostics messages of INTERBUS-S:

-    TR
     Transmit/Receive, not used.

-    RC
     Remote Check, the green LED indicates that the cable is properly con-
     nected to the remote bus input. When the INTERBUS-S master module is
     reset, the LED goes off.

-    BA
     Bus Active, the green LED indicates that INTERBUS-S data transmission is
     active

-    US
     Unit Supply, the green LED indicates that the INTERBUS-S signal voltage is
     available at the bus drop.

-    RD
     Remotebus Disable, the red LED indicates that the downstream remote bus
     cable has been switched off.

[3]   9-pin female D shell connector, INTERBUS-S OUT interface (remote bus inter-
       face, wire).

[4]   8-pin plug-in terminal inputs (3.5 mm spacing), no function.

[5]   8-pin plug-in terminal output (3.5 mm spacing) for KSR selection (outputs A3 to
       A5).

[6]   4-pin plug-in terminal 24 VDC voltage supply (3.5 mm spacing), for options, see
       section 7.2.

For the terminal assignment, 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 PSI 6101.321 / PST 6101.321 modules is IP 20. PSI 6101.321 / PST 6101.321 modules must be installed in a suitable housing or a suitable switch cabinet.

-    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.
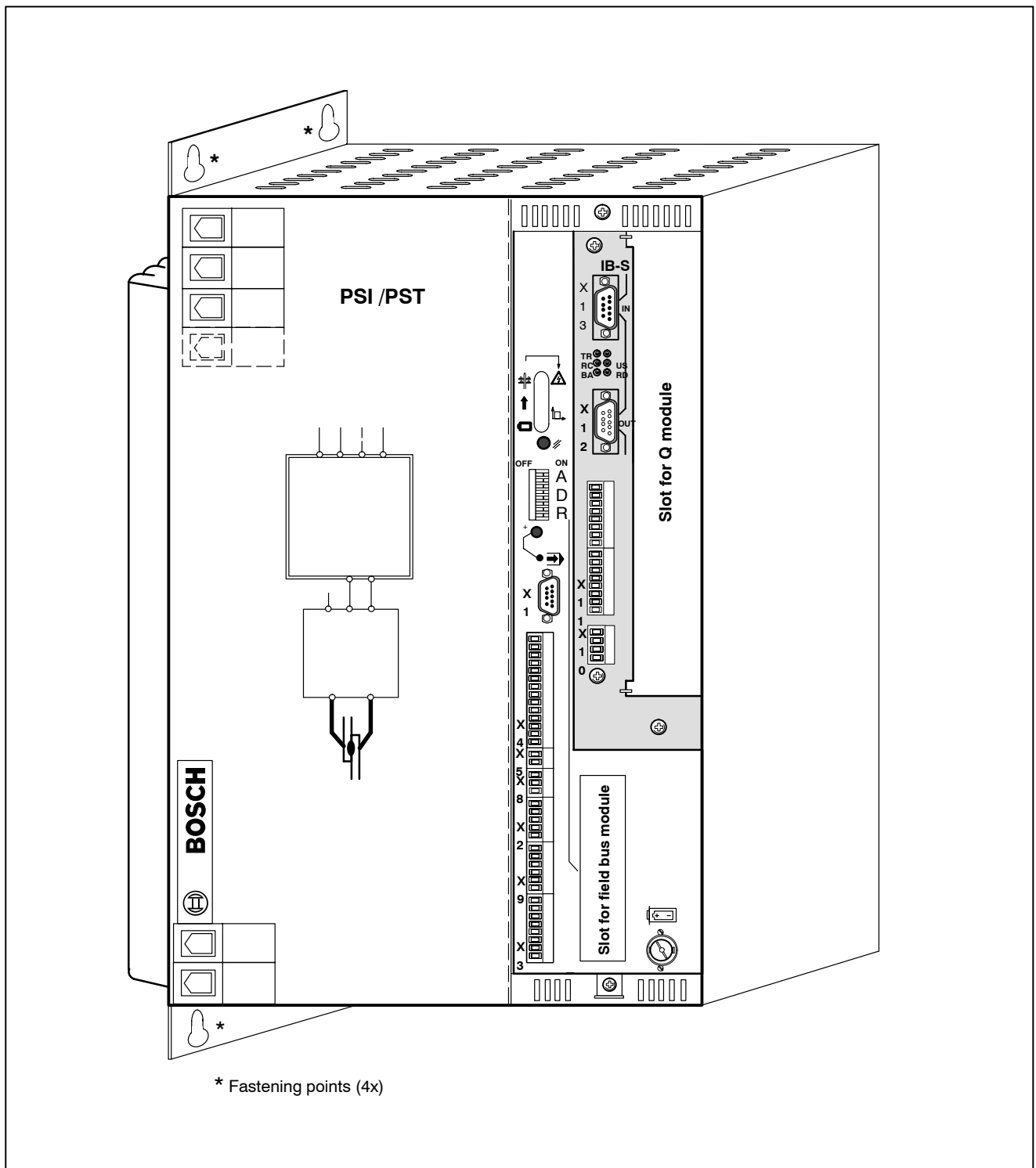
Figure 7: Timer module in housing

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
X3, KSR current sensor	shielded cable	0.75 mm^2 up to 100 m 2 x 2 x 0.75 mm^2 LiYCY corresponding to Bosch part number 1070 913 494
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 inputs E0 to E7, no function		
X11 parallel outputs A0 to A2, no function A6 to A7, no function outputs A3 to A5 (+24 V/0.1 A)	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 voltage drop = max. 10%
X12, IBS-OUT	i.a.w. INTERBUS S specification	i.a.w. INTERBUS S specification
X13, IBS-IN	i.a.w. INTERBUS S specification	i.a.w. INTERBUS S specification

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.

DIODE	RC ELEMENT
Diode, suitable for small DC relays	RC element for AC relays and AC motors
DIODE AND ZENER DIODE	RC ELEMENT
DI-ZD attenuation element for large DC contactors and defined drop-out times	RC element for spark quenching of inductive loads
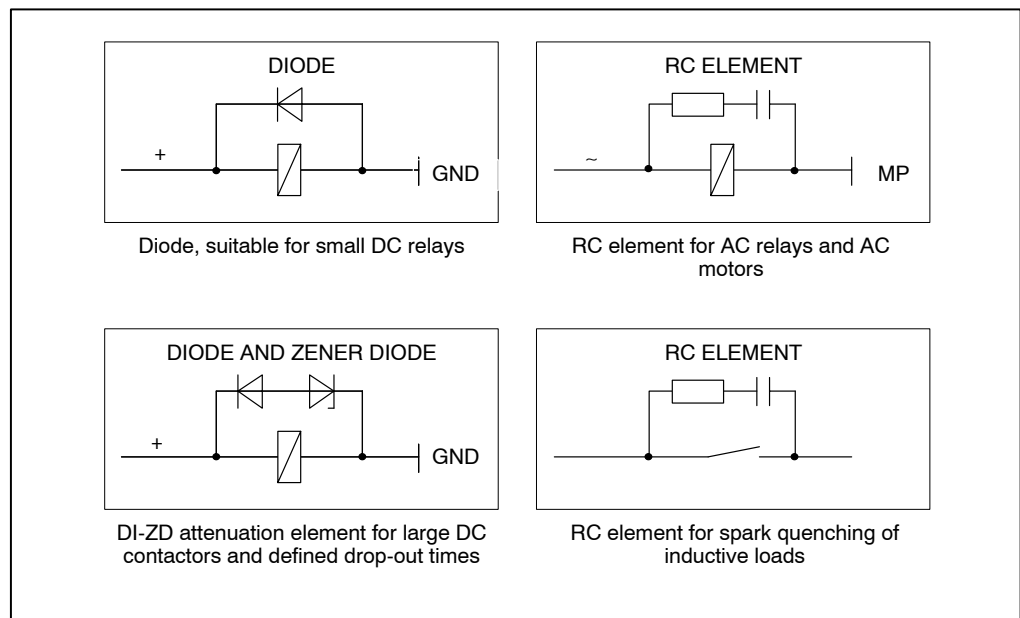
Figure 8: Examples of noise suppression

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 and serial I/O interfaces of the PSI 6101.321 / PST 6101.321.

> **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 6101.321 / PST 6101.321

Left side connectors		Right side

X13 IBS-IN

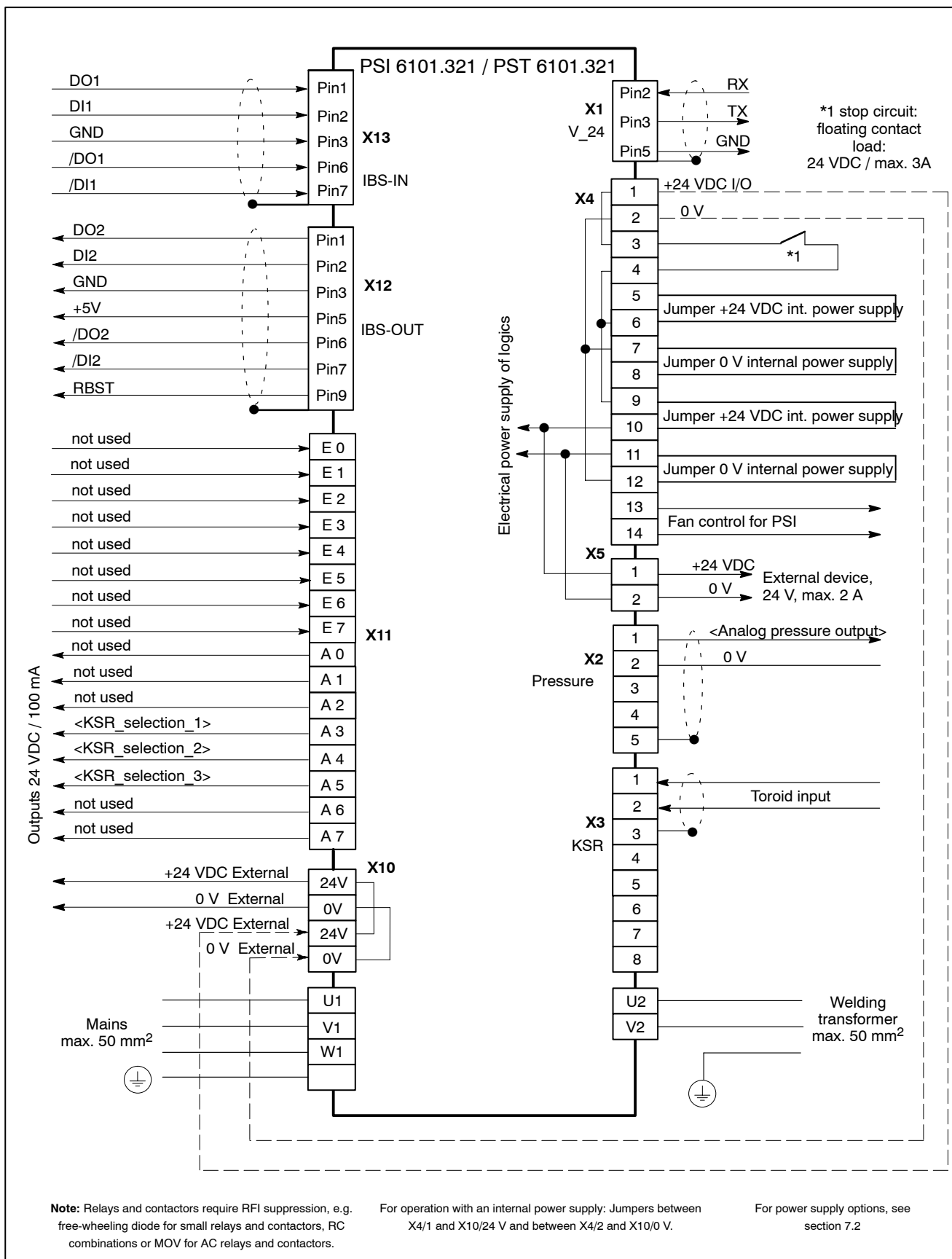| Signal	Pin
DO1	Pin1
DI1	Pin2
GND	Pin3
/DO1	Pin6
/DI1	Pin7

X12 IBS-OUT

Signal	Pin
DO2	Pin1
DI2	Pin2
GND	Pin3
+5V	Pin5
/DO2	Pin6
/DI2	Pin7
RBST	Pin9

X11 — Outputs 24 VDC / 100 mA

Signal	Terminal
not used	E 0
not used	E 1
not used	E 2
not used	E 3
not used	E 4
not used	E 5
not used	E 6
not used	E 7
not used	A 0
not used	A 1
not used	A 2
<KSR_selection_1>	A 3
<KSR_selection_2>	A 4
<KSR_selection_3>	A 5
not used	A 6
not used	A 7

X10

Signal	Terminal
+24 VDC External	24V
0 V External	0V
+24 VDC External	24V
0 V External	0V
	U1
	V1
	W1

Mains max. 50 mm²

X1 V_24

Pin	Signal
Pin2	RX
Pin3	TX
Pin5	GND

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

X4 — Electrical power supply of logics

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

X5

Terminal	Signal
1	+24 VDC — External device, 24 V, max. 2 A
2	0 V

X2 Pressure

Terminal	Signal
1	<Analog pressure output>
2	0 V
3	
4	
5	

X3 KSR

Terminal	Signal
1	Toroid input
2	
3	
4	
5	
6	
7	
8	
U2	Welding transformer max. 50 mm²
V2	

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 operation with an internal power supply: Jumpers between X4/1 and X10/24 V and between X4/2 and X10/0 V.

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 cable table, 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.
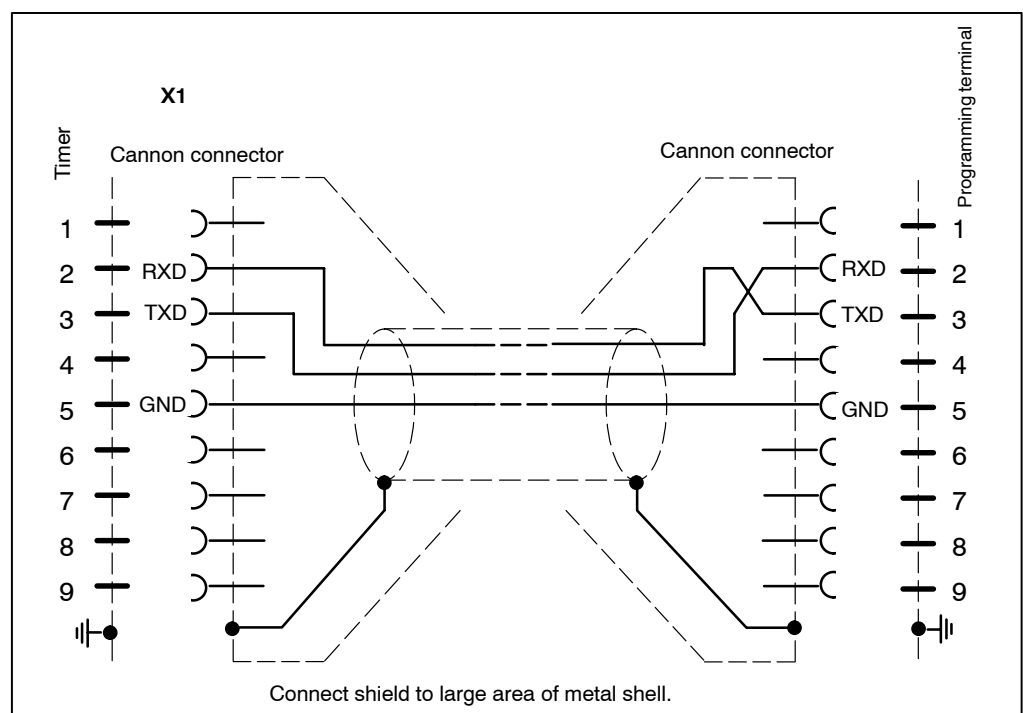

Figure 10: Connection of the V24/RS232 interface

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 6101.321 / PST 6101.321 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.

7.1.3   KSR sensor (Toroid) X3

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

The KSR sensor (weld current sensor) is inserted in the secondary circuit of the welding unit. Installation must be made in such a way, where the sensor is protected from mechanical damage by the part as well as be shielded against splashing of weld material.

As the actual installation is concerned, remember that improper placement of the KSR sensor may lead to measuring faults.

In order to keep these faults as small as possible, the following cautions must be observed:

- The current carrying conductors must be run through the KSR sensor as straight and as centrally oriented as possible. The sensor should be mounted as far away from current carrying bus bars and high current carrying conductors in order to prevent noise effects of external fields.

- No metal parts, which can be magnetized should be used to mount the KSR sensor. Copper and brass are to be preferred.

- To be able to assess possible measuring fault, calibration measurements (scalings) should be made in each case, using a suitable current module.

- The maximum cable length between the KSR sensor and the PSI 6101.321 / PST 6101.321 is 100 meters. This limit must not be exceeded.

- The connection between the KSR sensor and the PSI 6101.321 / PST 6101.321 consists of a shielded cable. The shield must be connected to X3/3 of the PSI 6101.321 / PST 6101.321. The shield at the sensor end is left unconnected.

The KSR cable value (ohmic resistance of KSR sensor, cable and connector) can be measured by a measuring circuit test during the last half-wave of [SQZ] (*Basic Setup - Sequence Setup* in the BOS-5000).

The measuring circuit test is evaluated for the following events:

- ohmic resistance less than 7 Ω =   *Measuring circuit shorted.*,

- ohmic resistance between 12 and 950 Ω =   *Measuring circuit o.k.*,

- ohmic resistance higher than 1100 Ω =   *Measuring circuit open*.

Measuring circuit values in the intermediate ranges lead to an ambiguous evaluation of the measurement.

In the use of KSR sensors with robots or similar devices, certain cable segments are subject to severe mechanical stress. This must be kept in mind when selecting the cables and the design of the cable connection.

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 acknowledged when corrected.

7.1.7   Synchronization voltage (only with PST)

A fault in the synchronization voltage is automatically acknowledged when corrected.

Your notes:

7.2   Power supply

7.2.1   Internal power supply

Configuration A

The power supply to PSI 6101.321 is completely provided by the power unit (internal supply).

PSI 6101.321 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.

-          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**
             (only outputs for PSI 6101.321)
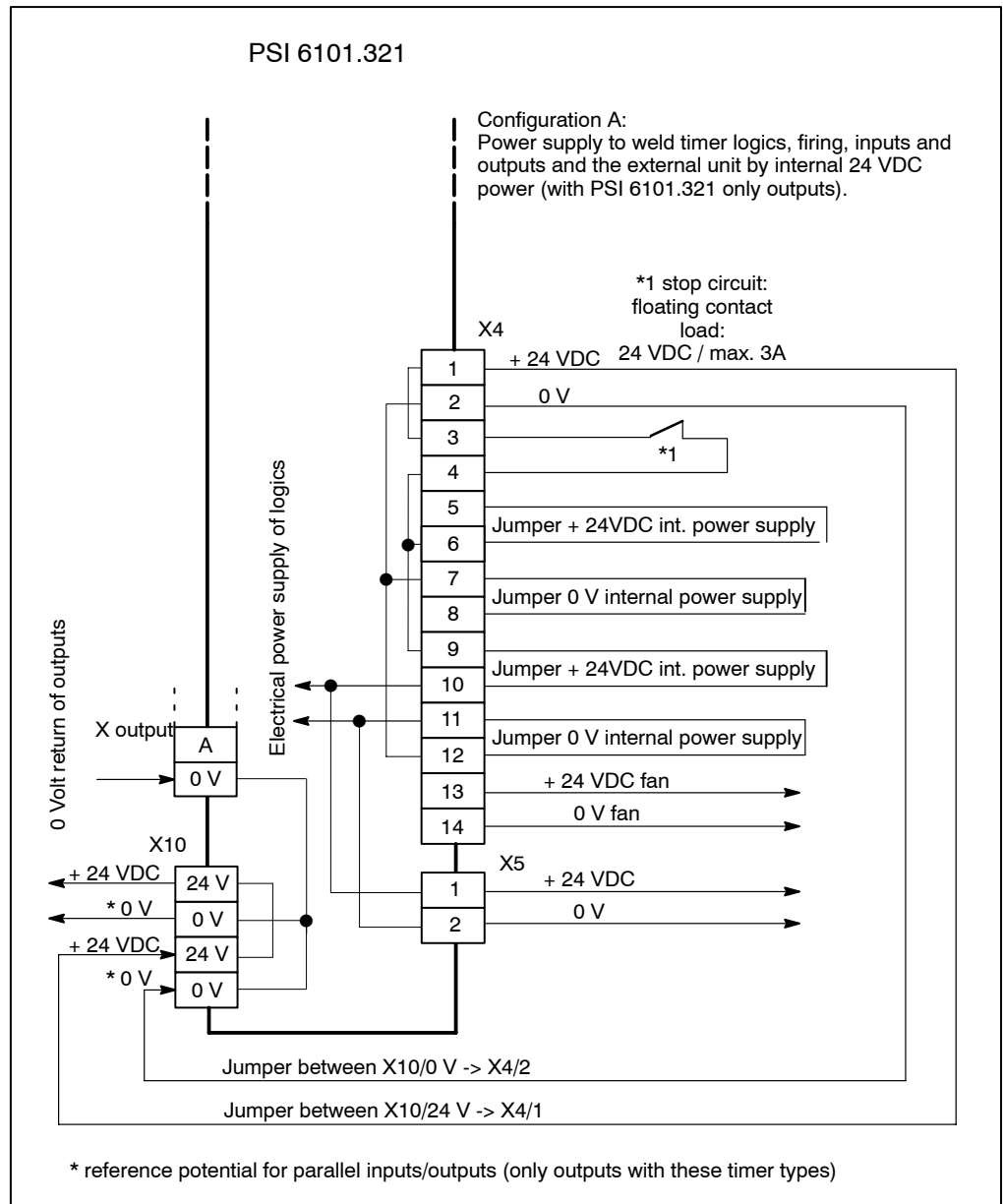 -   the **power supply** to the **external unit**.

PSI 6101.321

Configuration A:
Power supply to weld timer logics, firing, inputs and outputs and the external unit by internal 24 VDC power (with PSI 6101.321 only outputs).

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

X4

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

Electrical power supply of logics

0 Volt return of outputs

X output

A

0 V

X10

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

X5

1	+ 24 VDC
2	0 V

Jumper between X10/0 V -> X4/2

Jumper between X10/24 V -> X4/1

* reference potential for parallel inputs/outputs (only outputs with these timer types)

Figure 11: Internal power supply

7.2.2   External power supply

Configuration B

The power supply to PSI 6101.321 / PST 6101.321 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 %.
- PSI 6101.321
    - Making current: approx. 2.0 A, duration approx. 10 ms, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current) and the current of the external unit connected to X5.
    - continuous current: approx. 1.5 A, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current) and the current of the external unit connected to X5.
- PST 6101.321
    - Making current: approx. 1.5 A, duration approx. 10 ms, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current) and the current of the external unit connected to X5.
    - continuous current: approx. 1.0 A, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current) and the current of the external unit connected to X5.

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.

- 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** (only outputs for PSI 6101.321 / PST 6101.321)
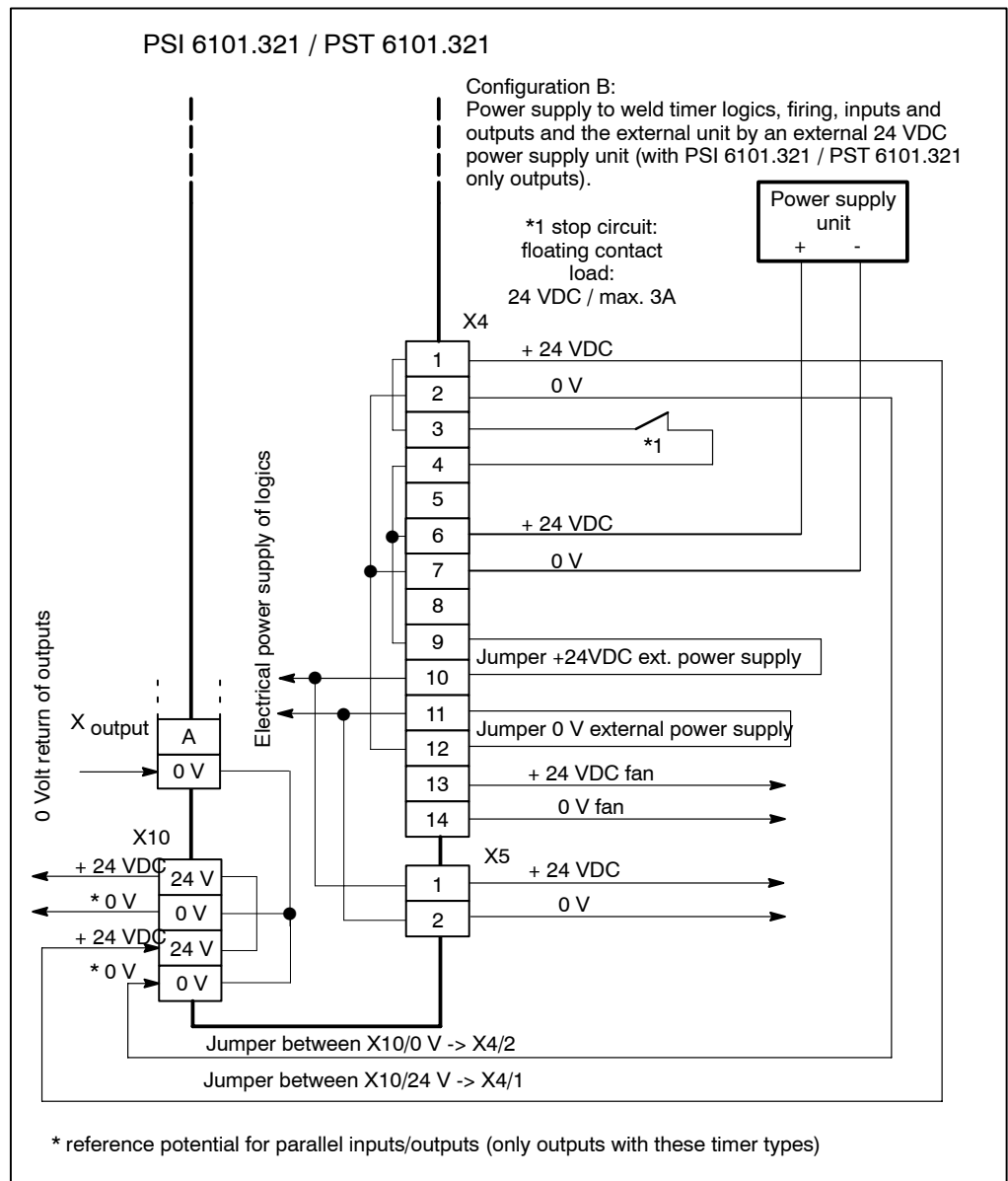   - the **power supply** to the **external unit**.

Figure 12: External power supply

Configuration C

The I/O range of the PSI 6101.321 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%.
- PSI 6101.321
    - 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.

Functions:

- When the welding network is switched off, the following interfaces will be interrupted:
    - no communication via the parallel I/O interfaces possible
    - communication via the serial I/O interface 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**
      (only outputs for PSI 6101.321)
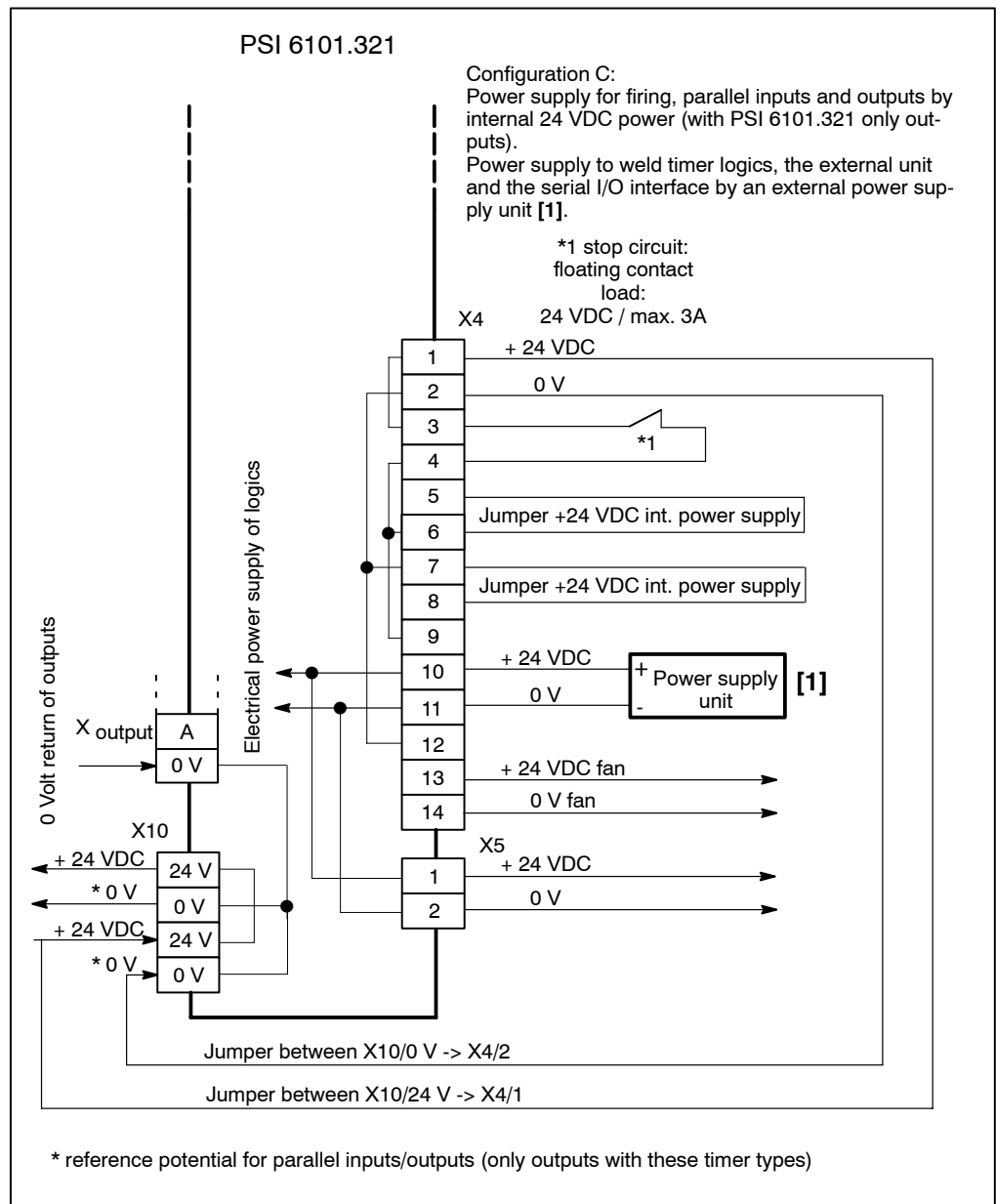   - the **power supply** to the **external unit**.

Figure 13: Internal and external power supply

Configuration D

If the external 24 V DC supply to PSI 6101.321 / PST 6101.321 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%.
- PSI 6101.321 / PST 6101.321
    - Making current: approx. 0.2 A, duration approx. 10 ms, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current).
    - continuous current: approx. 0.1 A, plus the current of the inputs and outputs (with PSI 6101.321 / PST 6101.321 only the output current).

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

- maximum ripple <5%, tolerance -15% / + 20%.
- PSI 6101.321
    - 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.

- PST 6101.321
    - 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.

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**
    (only outputs for PSI 6101.321 / PST 6101.321)
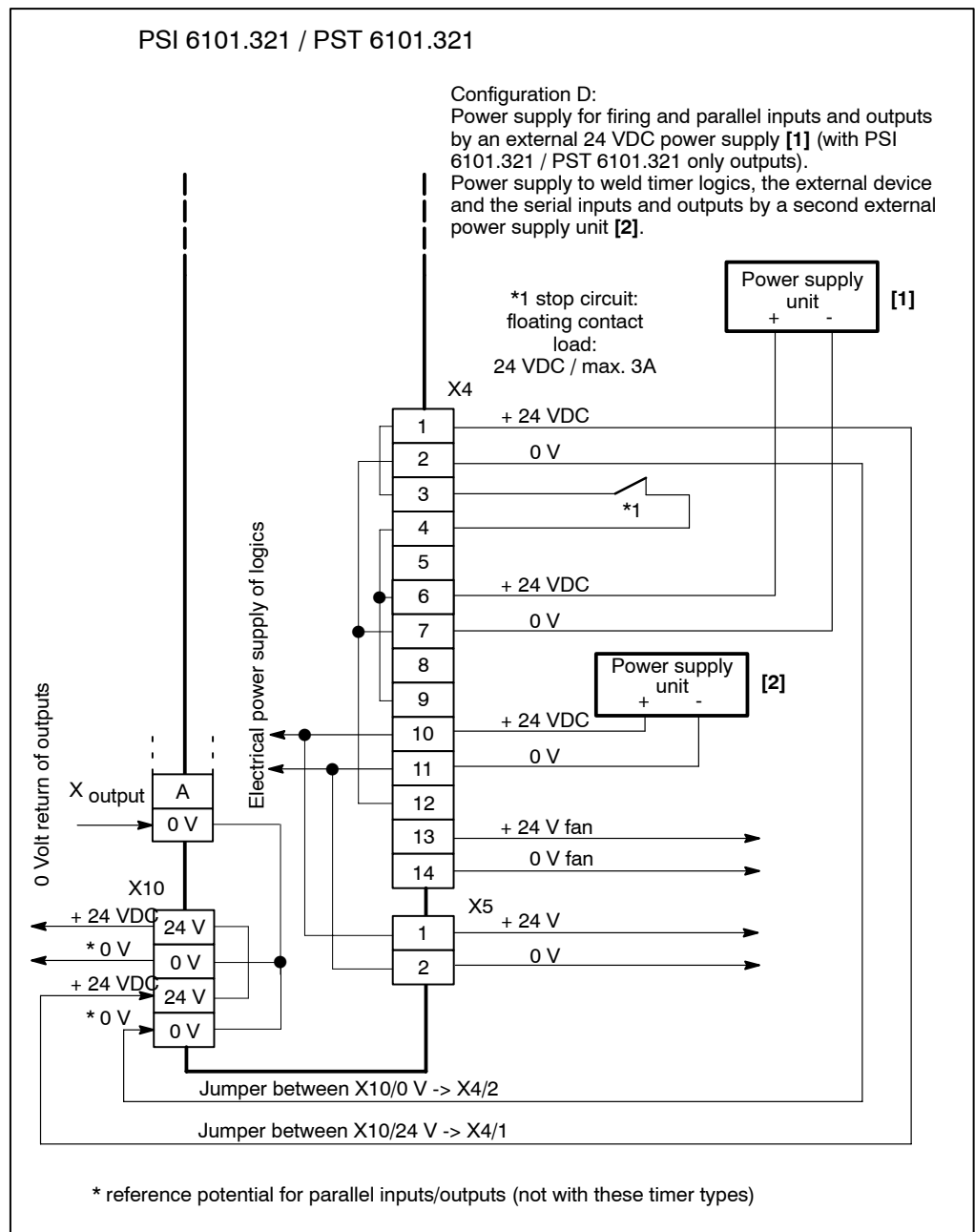 - the **power supply** to the **external unit**.

Figure 14: External power supply by two power supply units

Your notes:

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 and cable lengths" table in section 5.

The timer is equipped with a serial I/O interface. The serial interface has been prepared for networking within the Interbus-S (Messrs. Phoenix Contact) and uses a remote bus interface (wire).

The Interbus-S port of the timer operates according to profile specification C0 with specific enhancements.

Furthermore, a parallel output port is provided for driving a KSR selection.

Inputs

All inputs are served by the Interbus-S interface. The parallel inputs have no function.

Outputs

-        The serial outputs are served by the Interbus-S interface.

-        Three parallel outputs are used.

Power supply

The following applies to the parallel I/O's (not with PSI 6101.321 / PST 6101.321):

-        +24 V DC +20 % -15 %

-        maximum ripple <5 %

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

7.3.1   Serial inputs

The inputs are driven via the serial Interbus-S interface. The control word has the following structure:

Bit	Inputs of the PSI 6101.321 / PST 6101.321 according to the enhanced C0 profile, Messrs. Bosch
0	**<Start_1>**
1	**<Reset "Electrodes have been dressed">** (tip dressing)
2	**<Reset power unit fault>**
3	**<Reset "Electrodes have been replaced">** (counter reset)
4	**<Reset fault>**
5	**<Reset fault with WC>**
6	**<Reset Fault with Reweld>**
7	**<External Weld ON>** (with welding current)
8	**<Program selection_1>**
9	**<Program selection_2>**
10	**<Program selection_4>**
11	**<Program selection_8>**
12	**<Program selection_16>**
13	**<Program selection_32>**
14	**<Program selection_64>**
15	**<Program selection_128>**

<Program selection 1 to 128>

The **<Program selection>** has two meanings:

- If Start becomes active in connection with the specified program number, the selected program is executed.

- When the program number (now: stepper no.) is applied:
    - and the **<Tip dressed>** signal becomes active, the wear and tip dress counters will be affected for all electrodes (program no. = 0) or for a certain electrode (program no. = electrode number 1 to 31). The wear counters will be reset, the tip dress counters will be incremented by 1.
    - and the **<Electrode replaced>** signal becomes active, the wear and tip dress counters will be affected for all electrodes (program no. = 0) or for a certain electrode (program no. = electrode number 1 to 31). The wear and tip dress counters will be reset to 0.

Parameters for a total of 256 welding programs can be defined for the PSI 6101.321 / PST 6101.321. **<Program selection>** is e.g. made automatically through communication with the welding robot or the PLC.
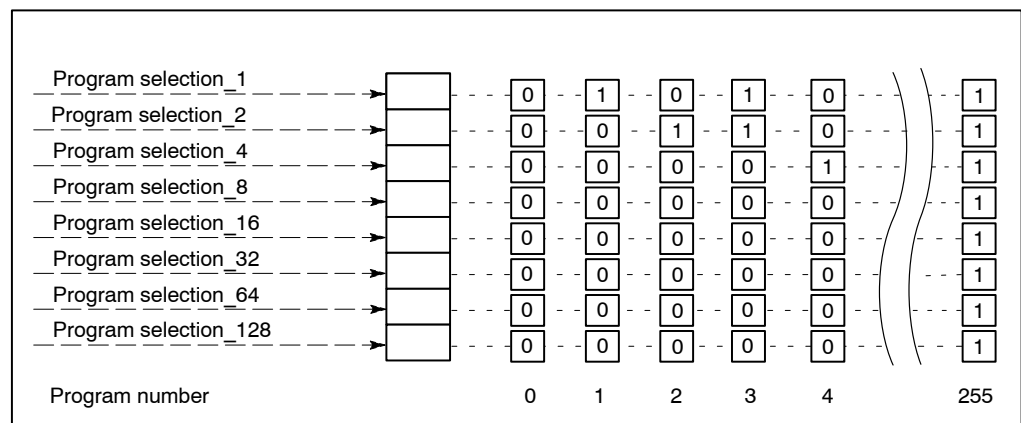

Figure 15: Example Program selection

Selection of the program number will energize the analog pressure output with the programmed pressure value.
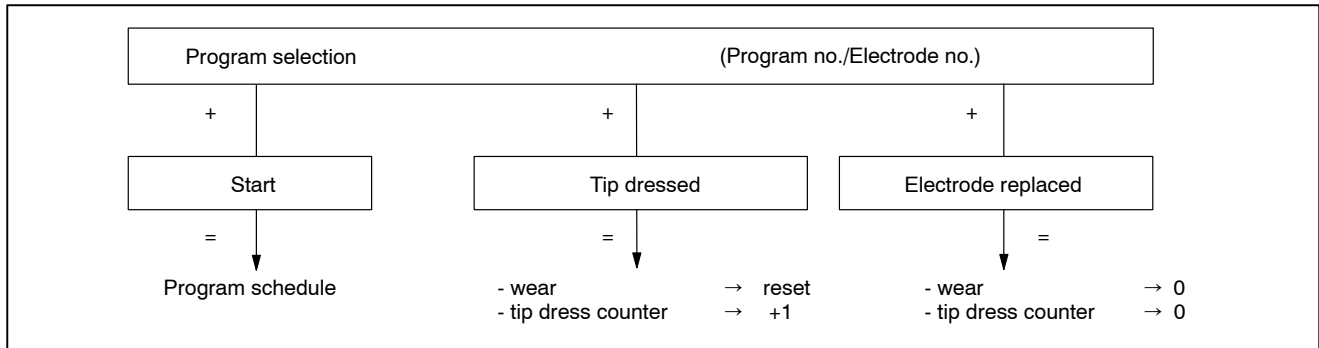
Influencing the counters via the input signals:

Program selection		(Program no./Electrode no.)
+	+	+
Start	Tip dressed	Electrode replaced
=	=	=
Program schedule	- wear → reset - tip dress counter → +1	- wear → 0 - tip dress counter → 0

Figure 16: Program selection and counter

NOTE

*If program number 0 (= electrode number 0) is selected with the Program selection signals and an Electrode replaced signal becomes high, the tip dress and wear counters of **all electrodes** are reset.*

If a program number (= electrode number 1 to n, n = maximum number of electrodes) is selected with the Program selection signals and an Electrode replaced signal becomes high, the tip dress and wear counters of the electrode selected with the signals for Program selection are reset.

*If program number 0 (= electrode number 0) is selected with the Program selection signals and a Tip dressed signal becomes high, the tip dress counters of **all electrodes** will be incremented and the wear counters will be set to a defined value.*

If a program number (= electrode number 1 to n, n = maximum number of electrodes) is selected with the Program selection signals and a Tip dressed signal becomes high, the tip dress counter is incremented by 1 and the wear counter is set to a defined value for the electrode selected by the number of the Program selection signals.

<Start_1>

Activating Start will synchronously start the [Sequence] in the timer (with the first subsequent positive half-cycle), and the solenoid valve signal is activated. Together with the start, the selected program number is taken over. The start signal also triggers off the pre-squeeze time [1. SQZ]. The start can be cleared again during [1.SQZ] and [SQZ], and the started [Sequence] can be interrupted. Latching of the [Sequence] only starts with 1.WELD (seam operation without latching).
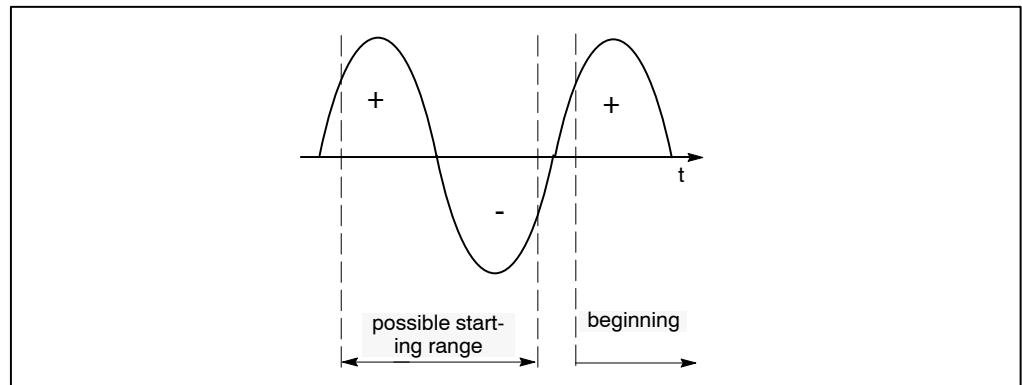

Figure 17: periodically synchronous start
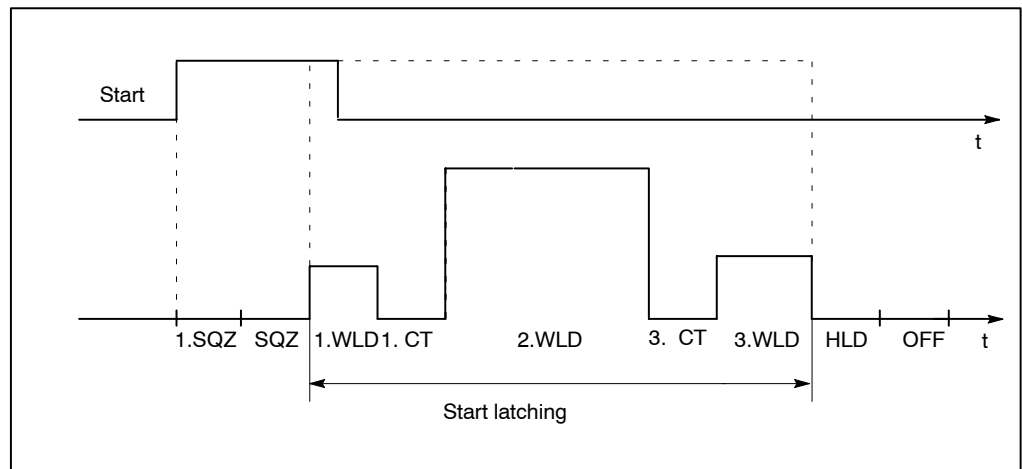

Figure 18: Latching of start with single spot and repeat mode

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
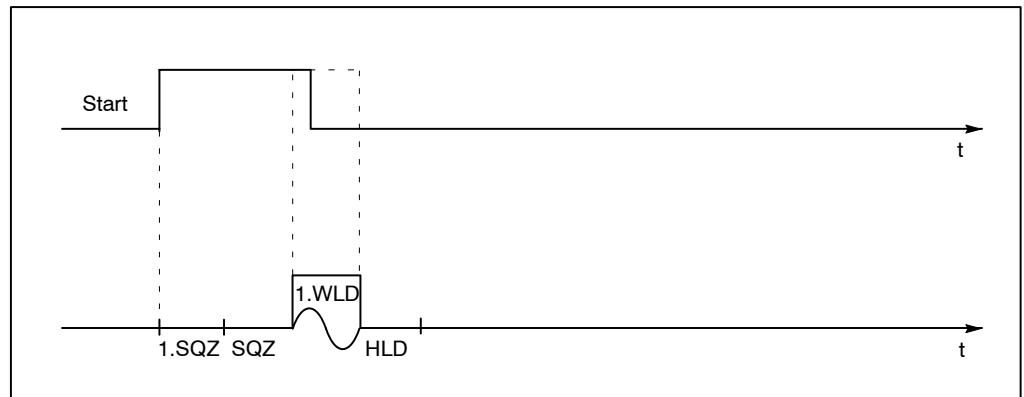
For firing, please refer to page 7-24.

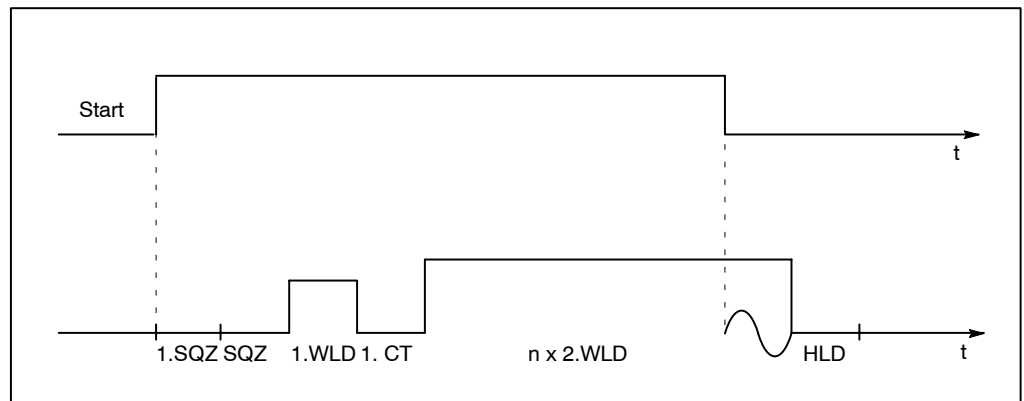*Figure 19: Start in seam mode (end during 1.WELD)*

Figure 20: Start in seam mode (end during 2.WELD)

<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 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 21: Firing settings

<Reset fault>

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 key on the front panel of the PSI 6101.321 / PST 6101.321 or

- one of the following input signals

<Reset fault>

This signal resets the displayed fault. The cause of the fault must be cleared first. The **<Weld complete> (WC)** will not be output, the welding timer is switched into ready state. If the Start signal is present, it first has to be cleared and then set again.

<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 by pending start, the welding timer is switched into ready state.

<Reset Fault with Reweld>

Is required if the fault was caused by insufficient welding current. The spot is rewelded. This signal resets the displayed fault. The cause of the fault must be cleared first. By pending start, the welding timer is switched into ready state and will repeat welding this spot.

⚠ ─── **WARNING!** ───────────────────────

If a start signal is pending while **<Reset Fault with Reweld>**, the PSI 6101.321 / PST 6101.321 starts immediately with the [sequence]. This may result in dangerous machine movements. Always make sure in advance that nobody is in the dangerous range of the welding gun or the robot.

<Reset "Electrodes have been dressed">

Spot welds are programmed in dressing operation, which require a dressing of the electrodes in one or several operating cycles. When the *Stepper* function is active (*Programming - Welding Parameters - Stepper*) the signal **<Tipdress request>** signals that dressing is required. This signal will be reset and turned off as soon as a **<Reset "Electrodes have been dressed">** signal reports the completed dressing operation.

NOTE
---

*If program number 0 (= electrode number 0) is selected with the Program selection signals and a Tip dressed signal becomes high, the tip dress counters of **all electrodes** will be incremented and the wear counters will be set to a defined value.*

If a program number (= electrode number 1 to n, n = maximum number of electrodes) is selected with the Program selection signals and a Tip dressed signal becomes high, the tip dress counter is incremented by 1 and the wear counter is set to a defined value for the electrode selected by the number of the Program selection signals.
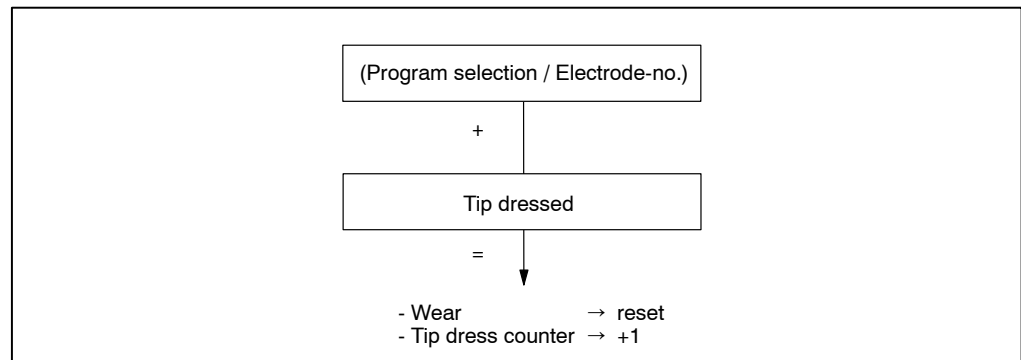

Influencing the wear counter with the input signals:


```
                    ┌─────────────────────────────────┐
                    │ (Program selection / Electrode-no.) │
                    └─────────────────────────────────┘

                                   +

                    ┌─────────────────────────────────┐
                    │           Tip dressed           │
                    └─────────────────────────────────┘

                                   =
                                   ↓

            - Wear                 →   reset
            - Tip dress counter    →   +1
```

Figure 22: Influencing the wear and tip dress counters using the tip dress signal
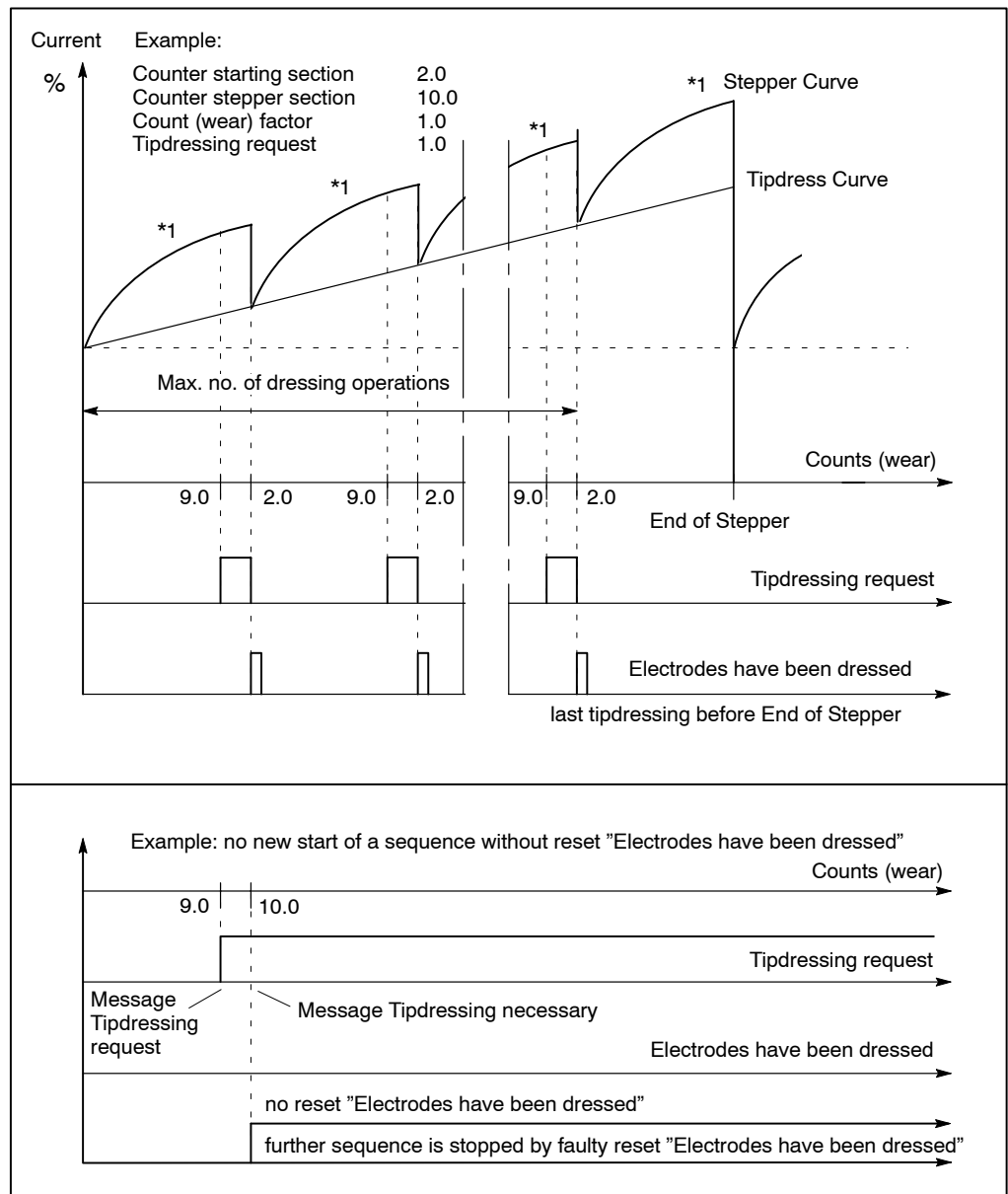
Figure 23: Example Tipdressing

NOTE

In the BOS-5000 software, the tip dress counter can be directly influenced by means of an input, e.g. if a used electrode is fitted.

<Reset "Electrodes have been replaced">

The timer signals the **<End of Stepper>**. Any further [sequences] can be disabled in the timer. This signal will be reset and turned off as soon as a **<Reset "Electrodes have been replaced">** signal reports, that the electrodes have been replaced.

> **NOTE**
>
> *If program number 0 (= electrode number 0) is selected with the Program selection signals and an Electrode replaced signal becomes high, the tip dress and wear counters of all electrodes will be reset.*
>
> *If a program number (= electrode number 1 to n, n = maximum number of electrodes) is selected with the Program selection signals and an Electrode replaced signal becomes high, the tip dress and wear counters are reset for the electrode selected by the number of the Program selection signals.*

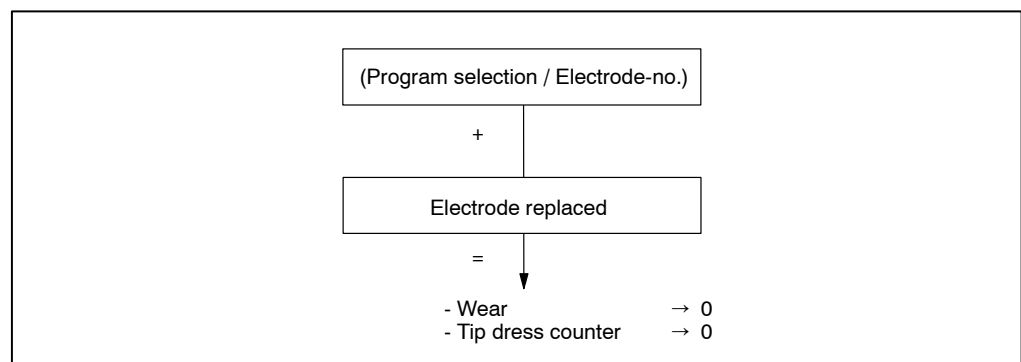Influencing the wear counter with the input signals:

```
        ┌─────────────────────────────────────┐
        │     (Program selection / Electrode-no.)│
        │                                       │
        │                  +                    │
        │                                       │
        │          Electrode replaced           │
        │                                       │
        │                  =                    │
        │                  ↓                    │
        │   - Wear                  → 0         │
        │   - Tip dress counter     → 0         │
        └─────────────────────────────────────┘
```

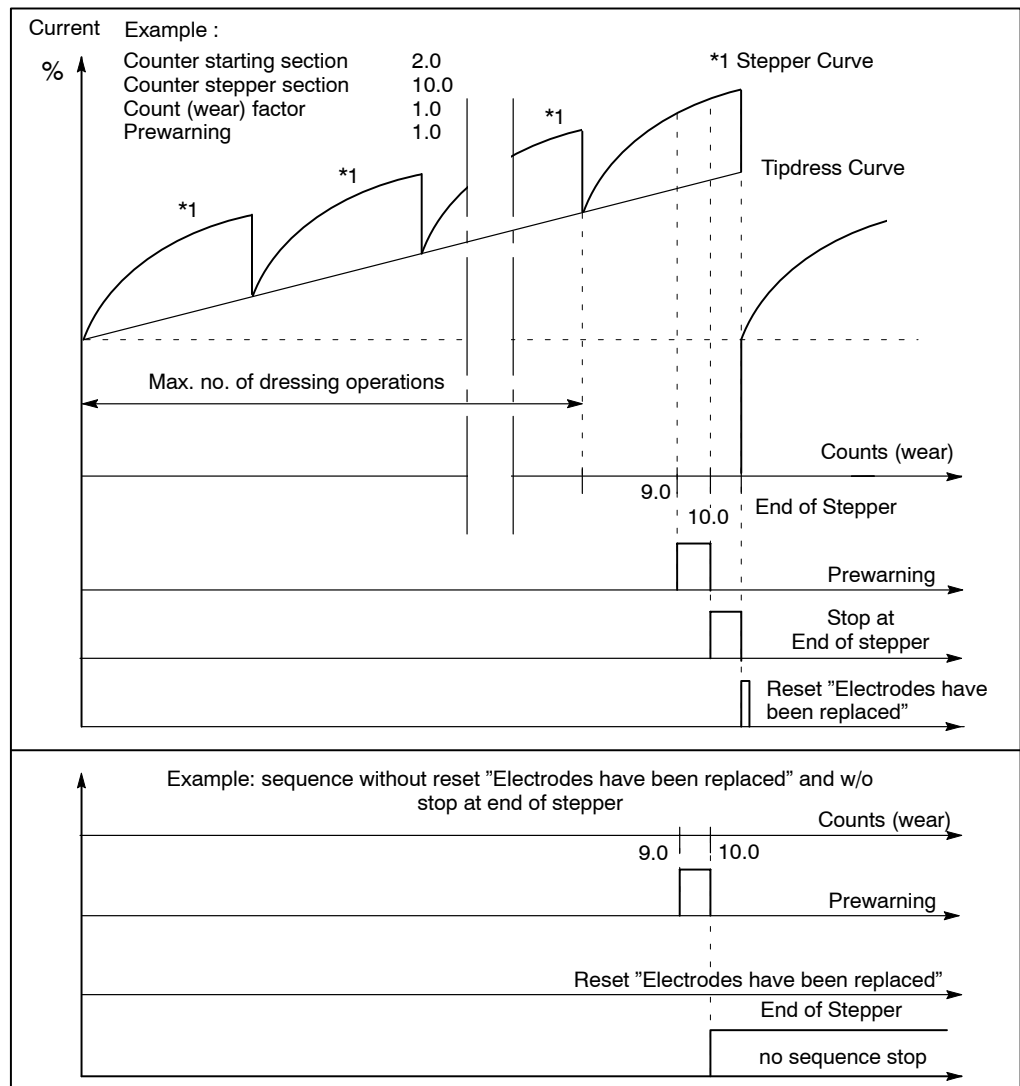*Figure 24: Influencing the wear and tip dress counters using the electrode replaced signal*

Figure 25: Example: electrodes replaced

NOTE

The response of the weld timer (stop or continued operation) to the reaching of the max. number of welds (end of stepper) is programmed in the Basic Setup, window Global Stepper-Setup.

NOTE

It is also possible to confirm with the BOS-5000 software that electrodes have been replaced.

\<Reset power unit fault\>

This input signal is directly passed to the power unit and has not effect on the timer. It is intended for fault acknowledgement in the power unit.

7.3.2   Serial outputs

The outputs are driven via the serial Interbus-S interface. The status word has the following structure:

Bit	Outputs of the PSI 6101.321 / PST 6101.321 according to the enhanced C0 profile, Messrs. Bosch
0	**\<Weld complete>**
1	**\<Tipdress request>** (tip dress inquiry)
2	**\<Prewarning>**
3	**\<End of Stepper>** reached
4	**\<Control ready>**
5	**\<Welding fault>**
6	**\<Without weld process monitoring>**
7	**\<Weld>** (with welding current)
8	not used
9	not used
10	not used
11	not used
12	not used
13	not used
14	not used
15	not used

<Control ready>

The **<Control ready>** signal indicates the ready status of the weld timer. In parallel, the green LED ⇑ 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

- main switch trip by weld without command (weld without command: the weld timer recognizes a current flow in the welding circuit for which no command was given), not with PSI 6101.321 / PST 6101.321

- a battery fault that has been defined as a fault in the *Fault Allocation* in the *Basic-Setup* menu, etc.
  Page 10-3: Messages concerning the timer status, page 10-4: Messages concerning current and time 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/O's or timer diagnostics.

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

- the **<Reset Fault>** signal, please refer to page 7-25

- the **<Reset Fault with WC>** signal, please refer to page 7-25

- the **<Reset Fault with Reweld>** signal, please refer to page 7-25

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

<Weld/No weld>

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

- 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
Weld external on	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 26: Firing settings

<Without weld process 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 weld process monitoring has been deactivated, you should always check the quality of your welds.*

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

Figure 27: 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.*

<Weld complete> (WC)

If the welding operation of a single spot is properly completed by the end of the last [weld time], the signal **<Weld complete>** is output for as long as the **<Start_1>** signal is true, or in the case of **<Start_1>** signal deleted, for a programmed number of mains cycles or milliseconds.

This signal serves as an acknowledgement for peripheral devices (e.g. robot control). The **<Weld complete>** signal takes effect after each weld in single spot mode, in repeat mode - after every spot. In seam mode the signal reports a faultless weld at the end of the seam.
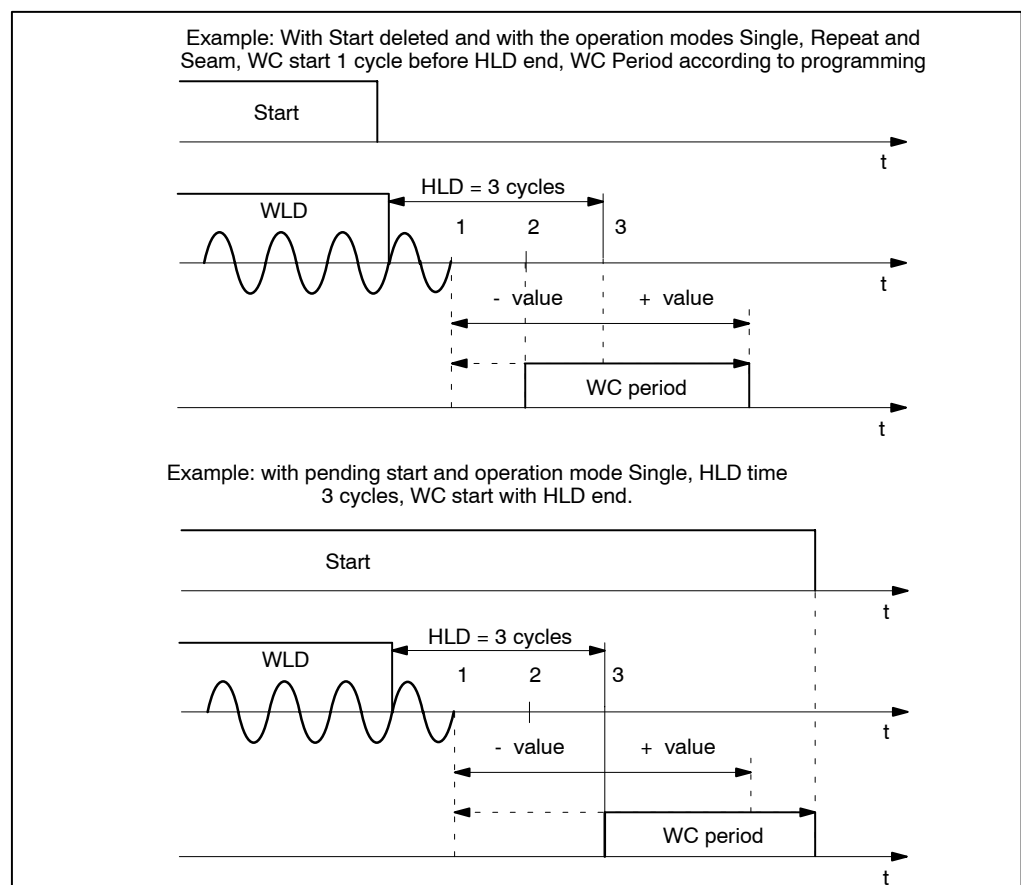
Figure 28: Example on Programming of the Weld complete contact WC

"Quick robot communication"

For example, if the **<Weld complete>** contact (WC) serves as start signal for the welding robot, delays in signal processing by the robot and its drives can be accounted for by programming a negative value for the WC.

In order to avoid these delays at least in part, WC start can be postponed to the hold time (HLD).

⚠

CAUTION!

In this case, the negative time value should be selected so as to ensure that the electrodes are already open when the robot drives are started.

☞

NOTE

The maximally programmable value for the beginning of WC is:
    number of HOLD time cycles (or milliseconds) less 1 cycle (or millisecond),
    maximally 50 cycles (or milliseconds) before the end of HLD.

Output of the **<Weld complete>** signal in the event of a welding fault can be prevented by appropriate programming in the *Basic-Setup*, menu item *I/O Parameters.*

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

<Tipdress request>

For electrode maintenance, the **<Tipdress request>** signal (electrode tip dressing) is activated. It signals that dressing is required. The signal will be reset and turned off as soon as the signal **<Reset "Electrodes have been dressed">** reports the completed dressing operation.

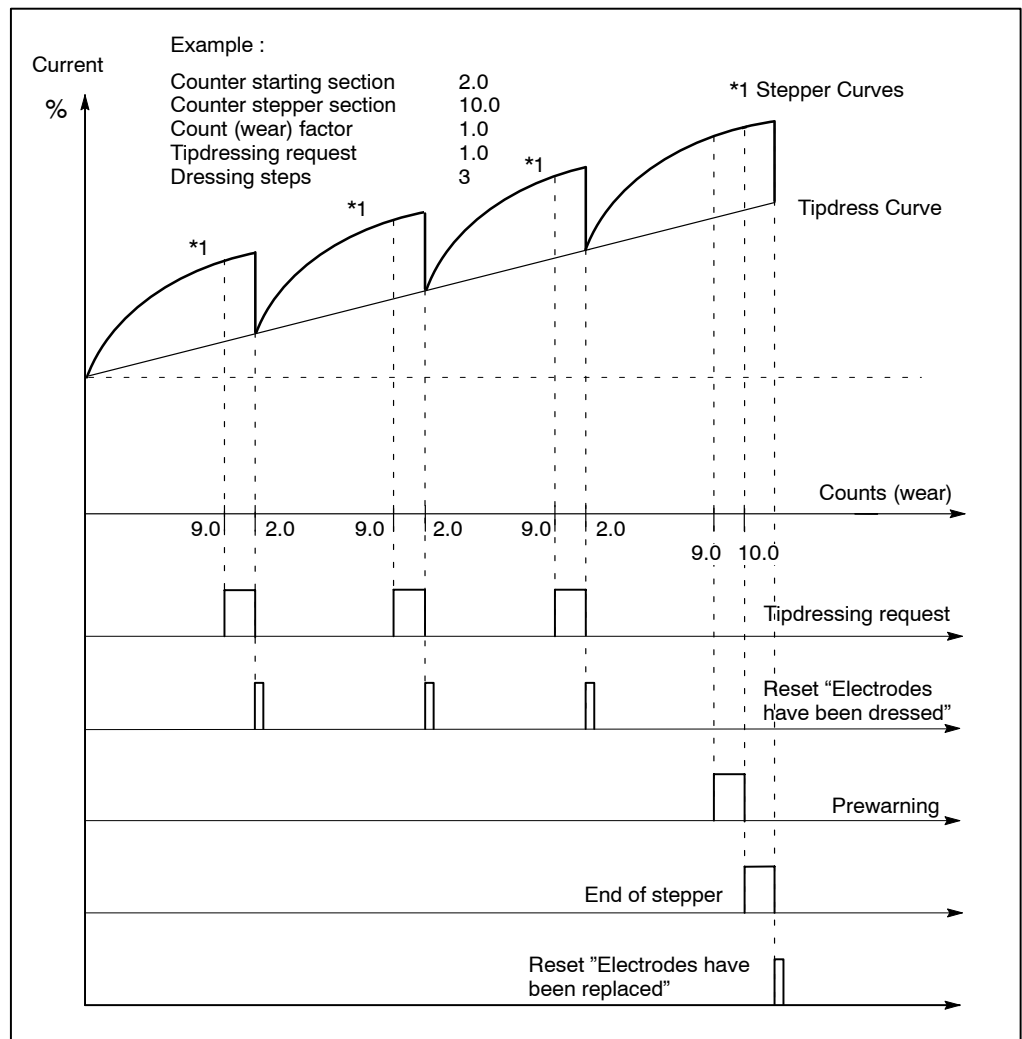If the **<Tipdress request>** is not acknowledged in time by **<Reset "Electrodes have been dressed">**, the message *Dressing* will be displayed at the programming terminal.

Figure 29: Example Tipdress request

For as long as the *Dressing* message is not acknowledged, either, by the **<Reset "Electrodes have been dressed">** signal, no new [Sequence] can be started.

<Prewarning>

The signal **<Prewarning>** is set when a wear is reached, which is programmed in the [sequence]. It signals that the **<End of Stepper> (**maximum life) for the electrode will soon be reached. The signal will be reset and turned off as soon as the **<End of Stepper>** is reached.

NOTE

Programming of the wear is accomplished in the Welding-Parameters menu in the Stepper window.

<End of Stepper>

Reaching of the **<End of Stepper>** (maximum electrode wear) is reported by this signal. Any further [sequence] may be disabled by appropriate programming. The signal will be reset and turned off as soon as the **<Reset "Electrodes have been replaced">** signal reports the completed electrode change.

NOTE

Stop at End of Stepper "Yes/No" is programmed in the Basic-Setup in the Global Stepper Setup window.

<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>** signal, please refer to page 7-25

- the **<Reset Fault with WC>** signal, please refer to page 7-25

- the **<Reset Fault with Reweld>** signal, please refer to page 7-25

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

Also refer to **<Control ready>** signal, page 7-32.

The output is activated with:

- single spot mode:
  after welding the spot. Welding of more spots is not possible wIthout fault reset.

- repeat mode:
  after the end of the spot which was recognized as a defective weld. Welding of more spots in repeat mode is not possible without fault reset.

- seam mode:
  after the end of the seam. Welding of more seams is not possible without fault reset.

NOTE

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

7.3.3   Parallel outputs

The timer drives the following parallel outputs (+24 V DC / max. 100 mA):

-        A3, **<KSR_selection_1>**

-        A4, **<KSR_selection_2>**

-        A5, **<KSR_selection_3>**

<KSR_selection>

The outputs serve for the control of a 3-to-1 switch in order to pass one out of a maximum of three KSR signals to connector X3 (KSR) of the timer.

The electrodes assigned to the welding programs influence outputs A3 to A5:

-        electrodes 1 to 9,   output A3 **<KSR_selection_1>** becomes high

-        electrodes 10 to 19,   output A4 **<KSR_selection_2>** becomes high

-        electrodes 20 to 29,   output A5 **<KSR_selection_3>** becomes high

When starting programs with electrode numbers 0, 30 or 31, the current control status of outputs A3, A4 and A5 is not affected.

Your notes:

8   Control diagrams

PST 6101.321 / PSI 6101.321　　BOSCH

<Start_1>
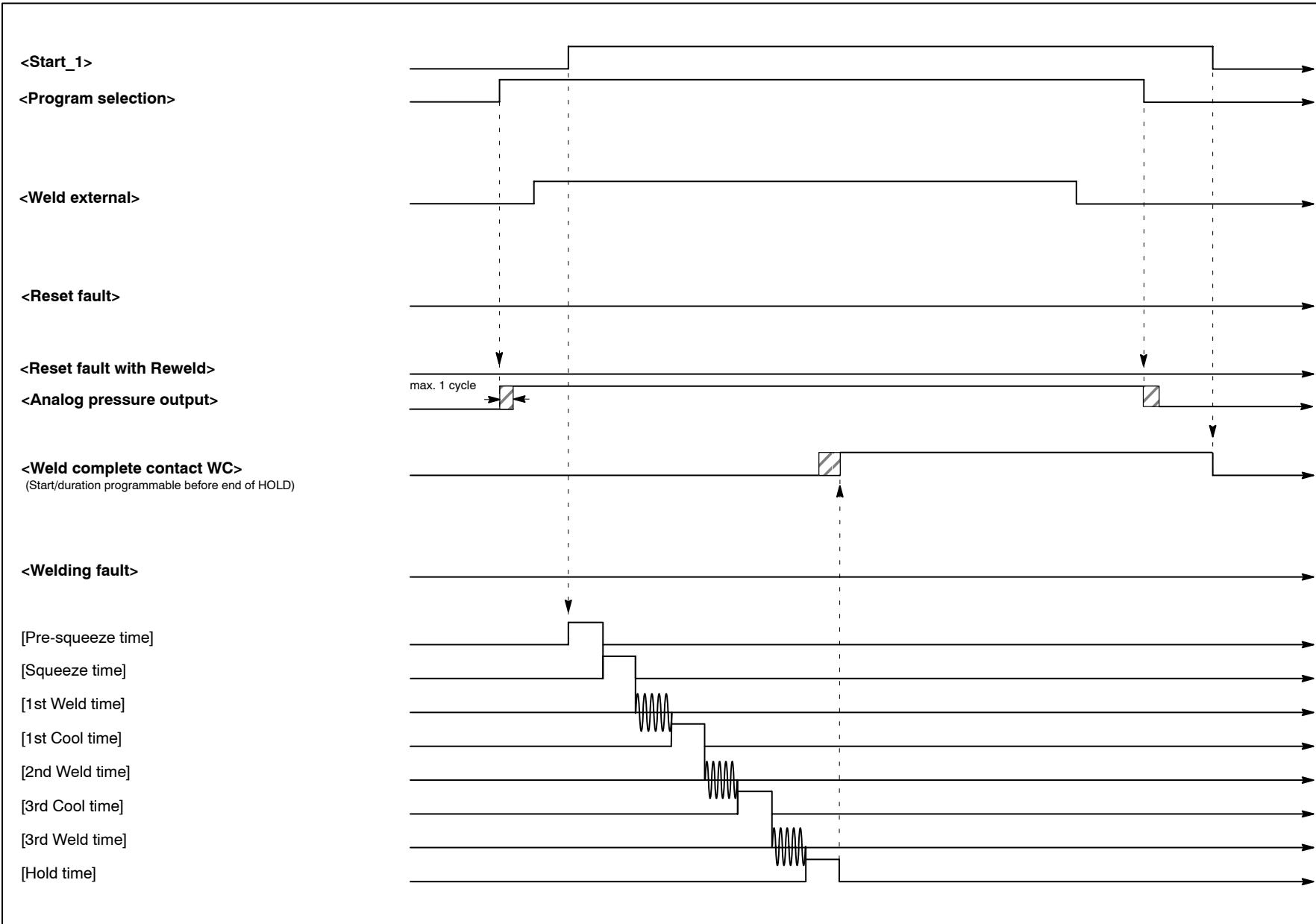
<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

max. 1 cycle

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

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

Figure 30: Example of a normal schedule, single spot

*2: possible range for schedule interruption by cancelling start

*2

<Start_1>

latching

<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

max. 1 cycle

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

min. 1 cycle

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]
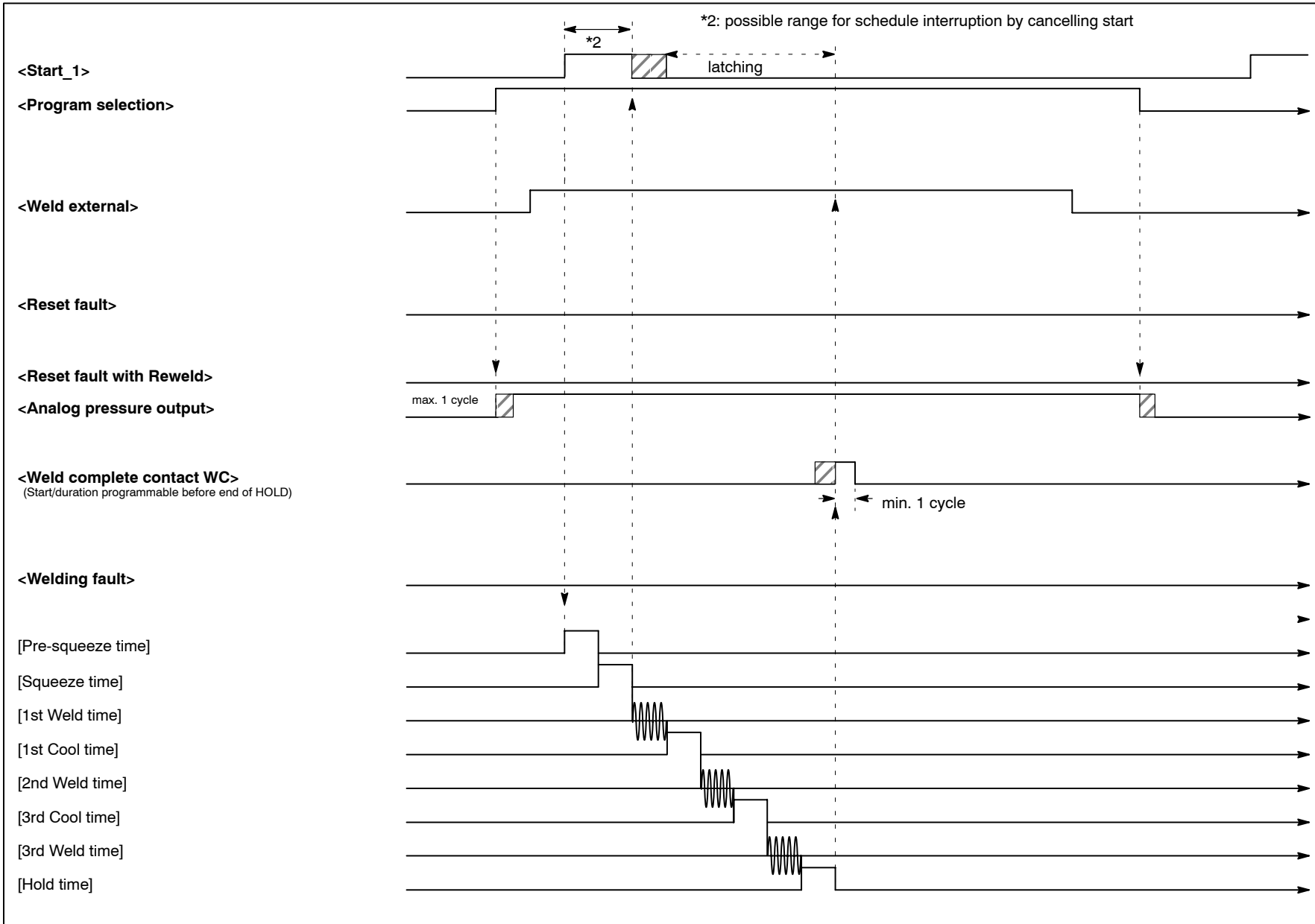
Figure 31: Example of possible range for sequence interruption, single spot

*1   The time between the squeeze time and the hold time corresponds to the total time of 1st weld time, 1st cool-time, 2nd weldtime, 3rd cooltime and 3rd weld time. The schedule is performed without welding current.

<Start_1>

<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

max. 1 cycle

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

<Welding fault>

[Pre-squeeze time]

*1

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

Figure 32: Example of no weld schedule, single spot

<Start_1>

<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>
max. 1 cycle

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

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

[Off time]

t>0 switch off

no start = no off time

1st spot

2nd/nth spot
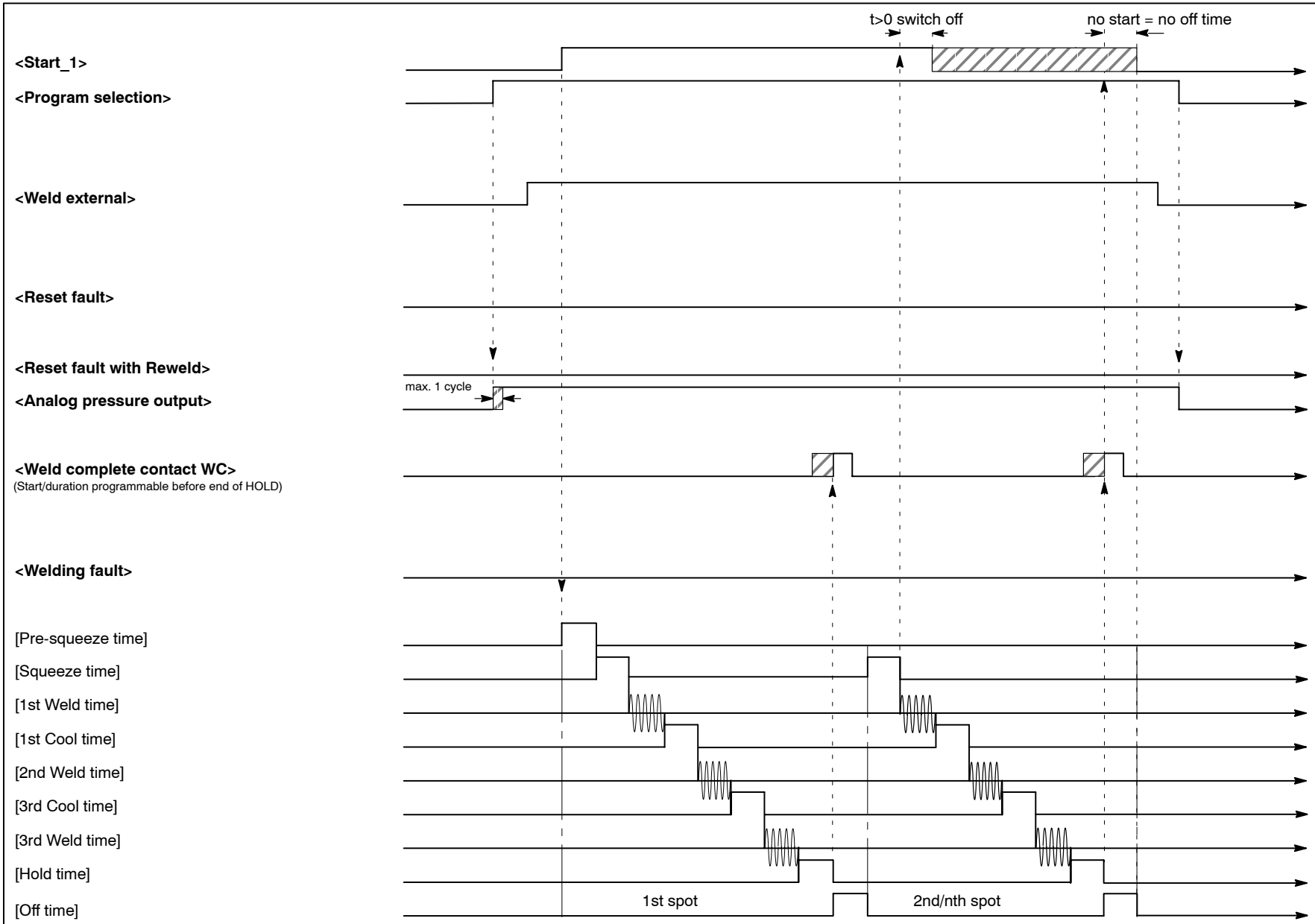
Figure 33: Example of normal schedule, repeat mode

Control diagrams

PST 6101.321 / PSI 6101.321

BOSCH

<Start_1>

<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

max. 1 cycle

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

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]
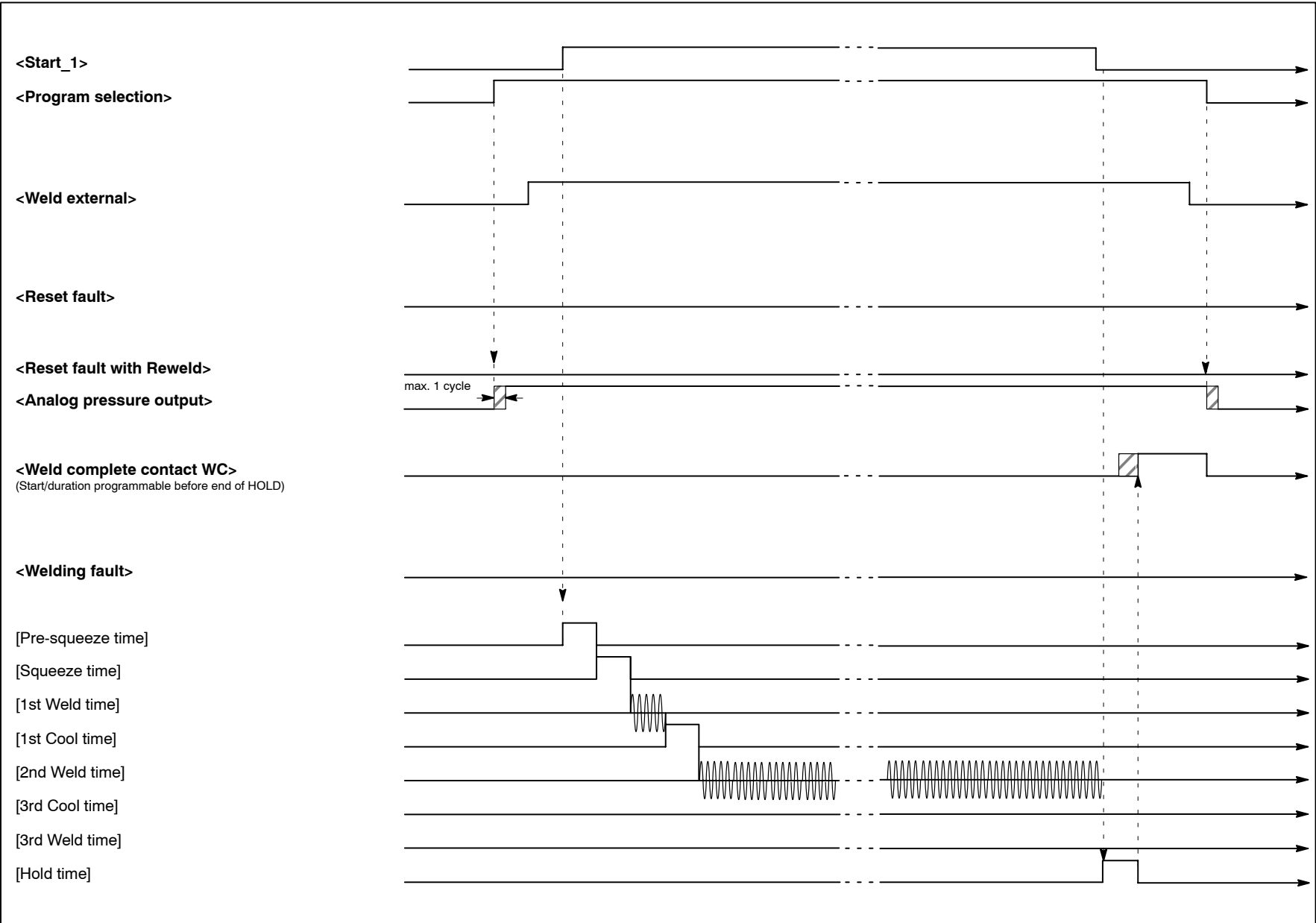
[Hold time]

Figure 34: Example of normal schedule, seam

*1 possible weld schedule termination time
*2 weld schedule hold time

<Start_1>

*1

Termination time/hold time

*2

<Program selection>

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

max. 1 cycle

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

min. 1 cycle

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

1 cycle

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

[Off time] (with Repeat mode)
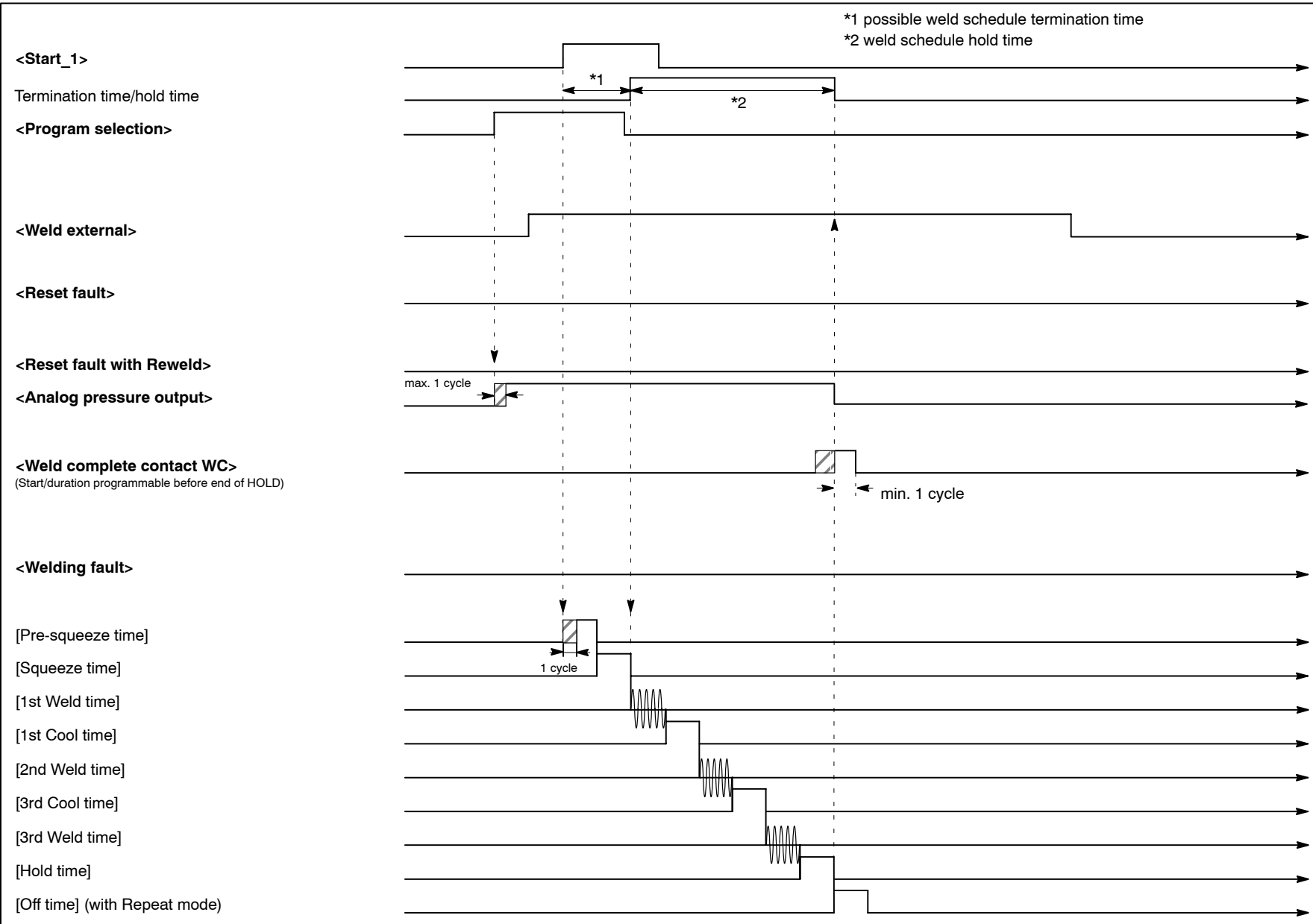
Figure 35: Example of possible termination time/hold time between program selection and start

Control diagrams

PST 6101.321 / PSI 6101.321

BOSCH

XXX no meaning

<Start_1>

<Program selection>   XXX

<Weld external>   XXX

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

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

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

[Off time]
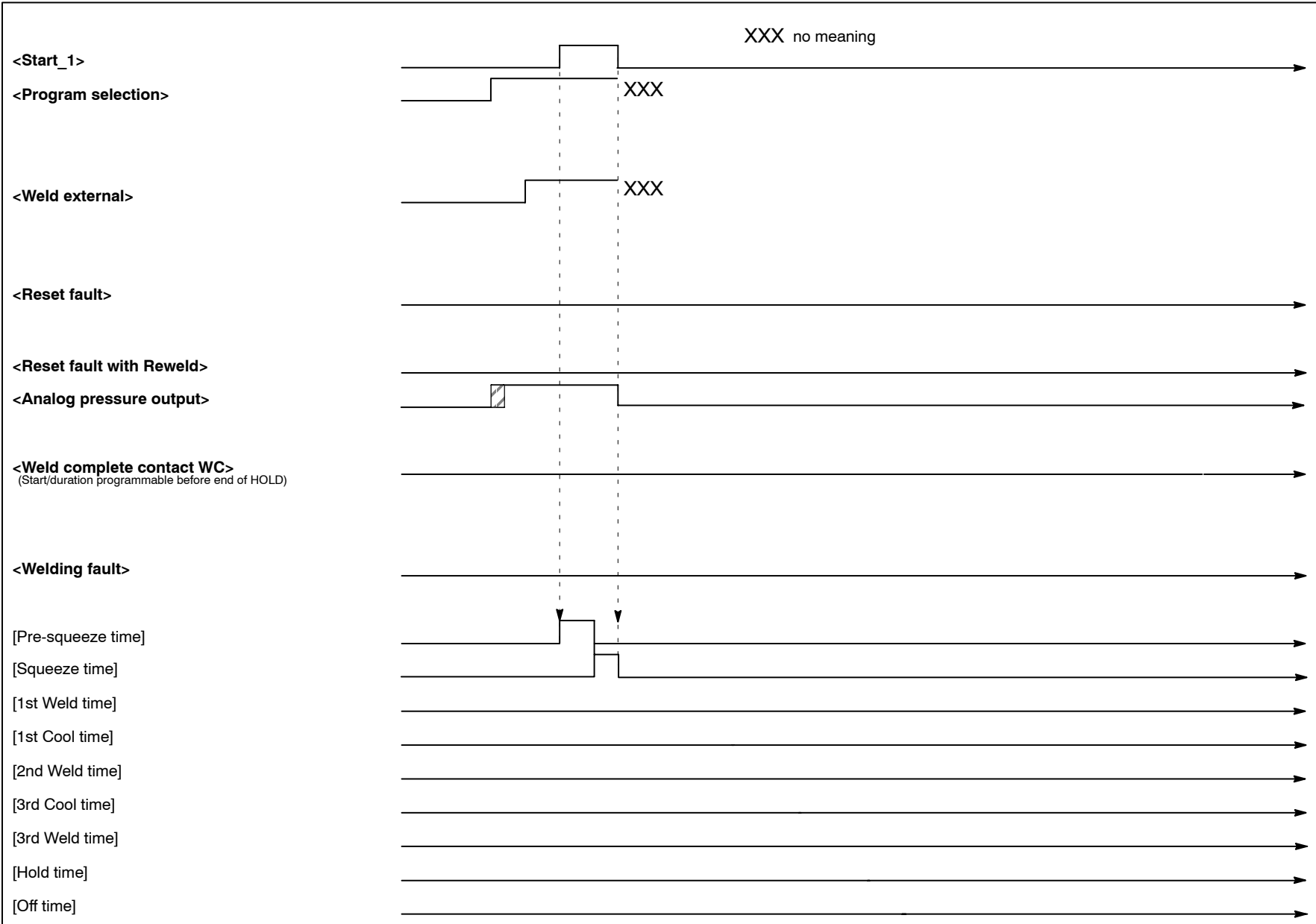
Figure 36: Example of sequence cancellation during squeeze times (1.SQZ, SQZ), before latching

XXX no meaning

<Start_1>

earliest new start, new program selection and parity change

<Program selection>

XXX

t > 0

<Weld external>

<Reset fault>

<Reset fault with Reweld>

<Analog pressure output>

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

<Welding fault>

[Pre-squeeze time]

[Squeeze time]

[1st Weld time]

[1st Cool time]

[2nd Weld time]

[3rd Cool time]

[3rd Weld time]

[Hold time]

[Off time]

Figure 37: Example of sequence interruption during latching

9   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 10, 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).*

9.1   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.

9.2   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 (if available for timer type in question) must be present for the Start:
  - Monitoring contact (MC)
  - Pressure input at connector X2
  - NBS enable

☞ **NOTE**

The **<External end of weld time>** *signal will cancel a sequence (not available for all weld timers).*

☞ **NOTE**

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

9.2.1   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/No weld external>** signal "off").

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

Parameter	Setting
Start Inhibit (T)	off
Weld/No weld internal (T)	off
Control Stopped	on
Start Inhibit (P)	off
Weld/No weld internal (P)	off
Sequence	Single Spot
Regulation	Standard
Regulation Mode	Phase angle
Stepper	off
Slope	off
Pre-Squeeze Time [1. SQZ]	3 cycles
Squeeze Time [SQZ]	17 cycles
1st Weld Time [1. WLD]	Without
1st Cool Time [1. CT]	Without
2nd Weld Time [2. WLD]	5 cycles
Number of impulses	1 impulse
3rd Cool Time [3. CT]	Without
3rd Weld Time [3. WLD]	Without
Hold Time [HLD]	5 cycles or 100 milliseconds
OFF Time [OFF]	Not used for single spot.

- Check whether the welding cycle is carried out.

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

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

9.3   *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*.
   - *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.
   - *I/O Parameters*
   Depending on the timer type, the parity bit is used for program selection via parallel inputs.
● Check whether the program selection is effected with the correct parity bit by the higher-level control unit (robot control, PLC). With serial program selection, the parity is not checked, data transmission is monitored by other processes.
   Check the programmed values for the duration and start time of the Weld Complete contact (WC), or adjust them to the higher-level control unit.
   - *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.
   - *Stepper Curves/Tipdress Curves*
   These programmed values are necessary later on during operation in order to compensate for the electrode wear. The inputs are experimental values and may be entered when commissioning has otherwise been completed.

___ **NOTE** _____

If you have access to weld timers which already contain the stepper curves you want to use, you may load them to the programming terminal and then to your weld timer.

-       *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 Time for [1st Weld Time], [2nd Weld Time] and [3rd Weld Time].

●   Deactivate Control Stopped for KSR mode.

●   Set maximum number of repeats. This number will only be active in those programs in which spot repetition (reweld) has been activated.

Suggestion concerning the settings for the selected program:

●   Deactivate Start Inhibit.

●   Check the assignment of the electrode to the program.

●   Set the Regulation Mode and the Standard monitoring mode.
When commissioning has been completed, these values can be adjusted to higher requirements of the production process (Mixed mode).

●   Deactivate spot repetition (reweld).

●   Select single spot mode for the sequence.

___ **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.

9.4 *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).

   - *Stepper, Monitor Stepper*
     Recommendation: First use a simple [Sequence] without electrode maintenance (stepping). The *Steppers* can be programmed towards the end of commissioning.

   - *Current* and *Time Monitoring*

● Turn *Current* and *Time 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 and Pressure Stepper*
     Recommendation: You should first use a simple [Sequence] without *Pressure* and *Pressure Stepper*. These values can be programmed towards the end of commissioning.

   - *Freely programmable Output*
     The *Freely programmable output* may be commissioned towards the end of commissioning.

9.5 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*.

9.6 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]

9.7 Activating *Stepper* (electrode maintenance)

The [%I] *Stepper* refers to the [Amount of current] and the [Pressure]. The stepper values are experimental values, it may not be possible to enter these values before having closely monitored the electrode lives.

Procedure for setting the *Stepper* functions:

● Program the *Stepper* and *Tipdress Curves* in the *Basic-Setup.*

● Activate *Stepper* in the *Programming - Stepper* window.

● Enter the electrode parameters for calculating the wear.

● Select a *Stepper Curve* and a *Tipdress Curve.*

● Enter the number of dressings.

● Program the *Stepper* for the new electrode, stepper and tipdressing areas.

● Program the Pressure Stepper values.

9.8   Activating monitoring

For quality assurance, *Current* and/or *Time 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.

- Activate *Time Monitoring*
  Select *Programming - Welding Parameters - Time Monitoring.*
  To facilitate the definition of the reference time and the admissible time tolerance, this window shows an *Actual value* display.

- Program *Monitor Stepper*
  Select *Programming - Welding Parameters - Monitor Stepper* and enter the monitoring values.

9.9   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

- Freely programmable output

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

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

- Adjusting the Stepper Reference in the copied program.

9.10 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.*

10   Messages

10.1   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.*

10.2   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*).

10.2.1   [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*

10.2.2 [B] - Electrode (Stepper) Messages

Code	Explanation	Additional code
31*	*End of Stepper*	Electrode no.
32*	*Prewarning*	Electrode no.
33*	*Tip dress request*	Electrode no.
34*	*Tip dress necessary*	Electrode no.
40*	*%I (Current) Prewarning*	Electrode no.
41*	*Maximum current*	Electrode no.

10.2.3 [C] - Messages Concerning the Timer Status

Code	Explanation	Additional code
80	*Stop Open circuit / no +24V*	-
81	*Weld without command*	-
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
89	*I/O-bus fault (only for WT with serial I/O bus)*	-
90		-
91	*Main switch tripped*	-
93	*Synchronization fault*	-
94	*Sequence inhibited*	Program no.
95	*Parity error*	Program no.
96		-
97		-
98		-
99	*Welding process*, cf. [D]	Monitoring code
100	*Supply voltage fault*	-
102	*No weld external*	-
103	*No weld internal*	-

10.2.4 [D] - Messages for Current and Weld Time Monitoring

Code	Explanation
1001	*Current measurement loop open*
1002	*Current measurement loop shorted*
1003	*No voltage 1. HW*
1004	*Primary voltage measurement fault*
1010	*No current* (standard mode)
1011	*No current 1. WLD* (mixed mode)
1012	*No current 2. WLD* (mixed mode)
1013	*No current 3. WLD* (mixed mode)
1020	*Current too low* (standard mode)
1021	*Current too low 1. WLD* (mixed mode)
1022	*Current too low 2. WLD* (mixed mode)
1023	*Current too low 3. WLD* (mixed mode)
1030	*Current too high* (standard mode)
1031	*Current too high 1. WLD* (mixed mode)
1032	*Current too high 2. WLD* (mixed mode)
1033	*Current too high 3. WLD* (mixed mode)
1040	*Series of welds below lower threshold* (standard mode)
1041	*Series of welds below lower threshold 1. WLD* (mixed mode)
1042	*Series of welds below lower threshold 2. WLD* (mixed mode)
1043	*Series of welds below lower threshold 3. WLD* (mixed mode)
1050	*Current measuring range exceeded* (standard mode)
1051	*Current measuring range exceeded 1. WLD* (mixed mode)
1052	*Current measuring range exceeded 2. WLD* (mixed mode)
1053	*Current measuring range exceeded 3. WLD* (mixed mode)
1060	*Weld time too short*
1070	*Weld time too long*

11 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. beause 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 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.

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

11.1   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 6101.321 / PST 6101.321 to provide data backup power. This battery supplies the RAM memory and the internal clock in the power down state. Battery life is 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.

12   Ordering

Spare parts

Designation	Part no.
PCB I/O level with Interbus-S interface	1070 077 832
Graduated plate (front cover) for PCB of I/O level	1070 079 710

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, 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 919 591
[14] no function, 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/O's: please refer to section 3.3	
[4] Inputs, no function X11	1070 916 553
[5] Outputs, X11: STKK 16-pin (3.5 mm)	
[6] 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

Your notes:

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
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	Medium-frequency power unit
PSL	PS power unit
PSP	PS programming module
PSS	PS timer
PST	Thyristor power unit
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: 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: entire weld time including cool times
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