CONTENTS

1 General Information

1.1 ⚠ Safety Instructions

Wherever you see this sign ⚠ you will find information on potential hazards. Please read these sections with particular care!

⚠ **Warning!**   Before opening the PN 300 disconnect the mains plug!

⚠ **Attention!**   If the fuse has to be changed, use only G fuse-link 5 × 20 according to IEC 127 (see 4.1)!

1.2 ⚠ Switching the Operating Voltage 230 V~/115 V~

Your PN 300 left the factory to 230 V~. Switching to 115 V~ requires the PN 300 to be opened, which should only be done by trained personnel.

Setting the Operating Voltage 115 V~

1. Disconnect the PN 300 from the mains.
2. Remove upper caps and loosen the screws below.
3. Identify the mains voltage switch with the following illustration.
4. Switch the voltage mains voltage switch (slide switch) located under the power switch to the indication "115".
5. Remove safety cover at the mains plug and replace the fuse with the fuse for 115 V supplied with the instrument.
6. Fasten upper caps and put the sticker supplied with the instrument for marking the switch-over to 115 V on to the type label.

Mains Voltage Switch

115 V position   230 V position

1.3 ⚠ Mains Connection

The design of the unit meets the requirements of safety class I according to EN 61010-1, i.e. all metal parts accessible from outside and exposed to contact are connected with the protective conducto of the supply network.
Power is supplied via a mains cable with earthing contact.

1.4 Installing the Power Supply Unit

The PN 300 should not be operated close to equipment that develops heat. To protect the PN 300 from thermal overload the slots on the rear side must not be covered and a free space of about 10 cm should be ensured.

1.5 Switching on

The PN 300 is switched on using the power switch at the front. The power switch separates the unit completely from the primary side of the transformer.

1.6 EMC

The PN 300 is interference-free according to EN 50081-1 and EN 50081-2. In order to fulfil the limit values in line with present standards, it is absolutely necessary that only cables which are in perfect condition be connected to the unit. The following information applies here:

− Metallic or metallized socket cases must be used for the serial interface RS-232C. The socket cases and the braided screen of the cables must be connected at the shortest distance possible. The signal earth must not be connected to the braided screen.
− After opening and closing the PN 300 ensure that all the locating elements and contact springs are installed as before and that all the screws have been tightened.

1.7 Inspection and Maintenance

If service is needed, due attention should be paid to the regulations according to VDE 0701. The PN 300 should only be repaired by trained personnel.

1.8 Warranty

GRUNDIG guarantees the perfect working order of the PN 300 for 12 months as from delivery.
There is no warranty for faults arising from improper operation or from changes made to the PN 300 or from inappropriate application.
If a fault occurs please contact or send your PN 300 to:

The PN 300 should be sent in appropriate packing - if possible in the original packing. Please enclose a detailed fault report (functions working incorrectly, deviating specifications and so on) including unit type and serial number.
Would you also kindly verify warranty cases by enclosing your supply delivery note. Any repairs carried out without reference to a valid warranty will initially be at the owner's expense.
Should the warranty have expired, we will, of course, be glad to repair your PN 300 as per our General Terms Of Assembly And Service.

1.9 Accessories Supplied

1 mains cable	
1 fine-wire fuse	(T 4 AL/250 V)
2 fine-wire fuses	(T 8 AL/250 V)
1 fine-wire fuse F1	(T 2 AL/250 V)
1 fine-wire fuse F2	(T 6.3 AL/250 V)
1 fine-wire fuse F3	(T 6.3 AL/250 V)
1 fine-wire fuse F301	(T 250 L/250 V)
1 fine-wire fuse F351	(T 250 L/250 V)
1 fine-wire fuse F401	(T 4 AL/250 V)
1 operating instructions	
1 label for indicating the switch-over to 115 V	

2 Application

The programmable low-voltage power supply unit PN 300 is an efficient triple power source. Sources A and B can supply voltages from 0 to 30 V in steps of 10 mV and currents from 0 to 2.3 A in steps of 1 mA.

The settings accuracy of the output voltage of both sources is 0.05 %. The interference voltage at the output terminals is less than $V_{rms} = 1$ mV.

The sources can be used independently (A and B) or in parallel connection (A + B). As the outputs have no ground connection, loads with voltage potentials up to 250 V (a.c.) can be connected.

Moreover, the power supply unit provides a constant voltage source of 5 V/2 A (C).

The instrument is equipped with a parallel interface according to IEEE-488.2 standard (GPIB) for measuring systems and a serial interface RS-232C for communicating with superior systems. All functions and parameters can be set, measurements can be carried out and measured values as well as the state of the instrument can be transmitted.

3 Set-up and Functional Description

3.1 Block Diagram
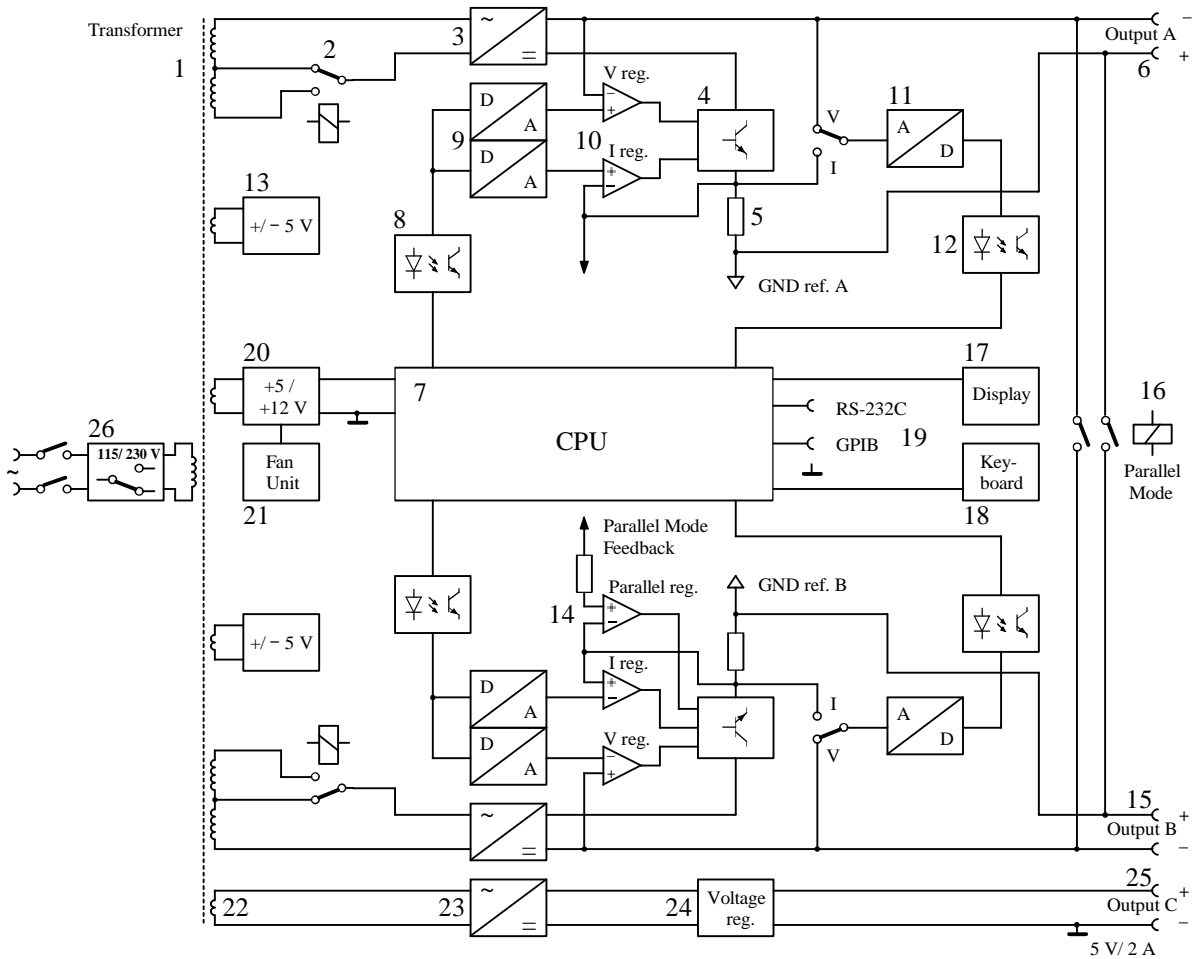
3.2 Description

The power supply unit PN 300 basically consists of two similar sources A and B that are free of earthing, a central processor unit with interfaces for communication and a constant voltage source of 5 V/2 A (source C).

The source A circuit is fed by the secondary winding (1) of the transformer. Here, the relay (2) is switched over in response to the load resistance. Rectification and filtration (3) of the voltage are the next steps. The required currents are provided at the output terminals (6) by means of the power transistors (4) and they are measured by the resistor arrangement (5). The internal operations are controlled by a one-chip microprocessor MCS-51 (7) the inputs and outputs of which are galvanically decoupled by the optocoupler (8). The D/A converter (9) provides reference voltages determined by the processor (7). These are transformed into respective voltages and currents at the output by means of the operation amplifier (10) and the power transistors (4). The real output parameters are tapped off via the A/D converter (11) and are led to the processor by the optocoupler (12).
The auxiliary source (13) ensures the power supply unit for the active components.

Source B works in the same way as source A. Moreover, source B can be connected in parallel to source A. In this case, the operation amplifier (14) takes over the control despite the separate feedback loop of source A. The output terminals of source A (6) and B (15) are connected in parallel by the relay contacts.

Reading of the keyboard (18) and indication on the display (17) are organized by the processor (7). The instrument can communicate with superior systems by means of the GPIB and
RS-232C interfaces (19).
The auxiliary source (20) handles the power supply unit of all digital circuits and of the fan unit (21).

The parameters 5 V/2 A of source C are pre-set. The voltage is taken from the secondary winding (22) of the transformer, it is rectified (23) and stabilized with the voltage regulator (24). The negative pole of the output terminals (25) is grounded at the instrument mass.

The nominal operating voltage of the instrument can be set using the change-over switch for the net voltage (26).

4 Technical Data

4.1 General Data

Nominal temperature:	+ 23 °C ± 1 °C
Operating temperature:	+ 5 to + 40 °C
Relative humidity:	20 to 80 %
Atmospheric pressure:	70 to 106 kPa
Operating position:	horizontal or inclined by ±15 °
Operating voltage:	sinusoidal alternating voltage (distortion factor < 5 %)
	115/230 V (+ 10 %/− 15 %), internally switchable
Frequency:	50 to 60 Hz (± 5 %)
Power consumption:	450 VA
Fuses:	T 4 AL/250 V (230 V~)
	T 8 AL/250 V (115 V~)
Safety class:	1, according to EN 61010 Part 1
Radio interference suppression:	EN 55011 Class B
Dimensions (L × H × D):	291 mm × 120 mm × 259 mm
Dimensions of packing:	345 mm × 148 mm × 398 mm
Weight of	
power supply unit:	about 6.75 kg
incl. packing and accessories:	about 8.4 kg

4.2 Specifications

4.2.1 Characteristics of Sources A and B

Output voltage:	0 to 30 V
Output current:	0 to 2.3 A
Setting accuracy of	
voltages:	± (0.05 % + 15 mV)
currents:	± (0.5 % + 10 mA)
Interference voltage at output:	$V_{rms} \leq 1$ mV for 15 Hz $\leq$ f $\leq$ 15 MHz
Accuracy of	
voltage measurement:	± (0.5 % + 100 mV)
current measurement:	± (0.5 % + 10 mA)
Stability of output voltage during	
net change:	± (0.01 % + 3 mV)
load change (Δ 100 %):	± (0.02 % + 6 mV)
Switch-time at change	
of voltage range:	$\leq$ 300 µs for ΔV $\leq$ 15 mV
Adjustment of	
voltage range:	in steps of 10 mV
current range:	in steps of 1 mA
Maximum output voltage	
referring to ground:	V_{rms} = 250 V
indication on display:	V_{max} = 30.00 V
	I_{max} = 2.300 A

4.2.2 Parallel Connection of Sources A and B

Output current: 0.3 to 4.6 A
Accuracy of current setting: $\pm$ (1 % + 20 mA)
Interference voltage on output: $V_{rms} \leq 2$ mV for 15 Hz $\leq$ f $\leq$ 15 MHz
Accuracy of internal current measurement $\pm$ (1 % + 20 mA)
Recovery time for load changs
   between 10 % and 100 %: ≤ 600 µs for $\Delta V \leq 30$ mV
Indication on display: $I_{max} = 4.600$ A

In all other respects the specifications listed in 4.2.1 apply.

4.2.3 Source C (5 V/2 A)

Output voltage: 5 V $\pm$ 5 %
Output current: max. 2 A
Interference voltage at output: $V_{rms} \leq 2$ mV

4.3 Display

The unit is equipped with two 16-digit alphanumeric LC display lines with lighting. It indicates voltage and current results, measuring unit and decimal point as well as the measuring functions and system messages.

4.4 System Interfaces

The power supply unit can be fully controlled and be read out via the parallel interface GPIB and the serial interface RS-232C.

4.4.1 Interface GPIB

Standards of the interface: ANSI/IEEE-488.1 1987, IEEE-488.2 1992
Functions of the interface: SH1, AH1, SR1, T5, L4, RL1, PP0, DC1, DT0, E2
Length of input buffer: 64 characters

4.4.2 Interface RS-232C

Data transmission rate: 1,200 to 9,600 Bd
Length of data word: 8 bit
Number of STOP bits: 1
Parity: none
Record: RTS/CTS, without
End characters on receiving: LF (10 dez.)
End characters on transmission: CR + LF (13 dec. + 10 dec.)
Length of input buffer: 64 characters
Length of output buffer: 256 characters

PN 300   **PC**

FG	1	1 FG
TXD	2	2 TXD
RXD	3	3 RXD
RTS	4	4 RTS
CTS	5	5 CTS
DSR	6	6 DSR
SG	7	7 SG
DCD	8	8 DCD
DTR	20	20 DTR
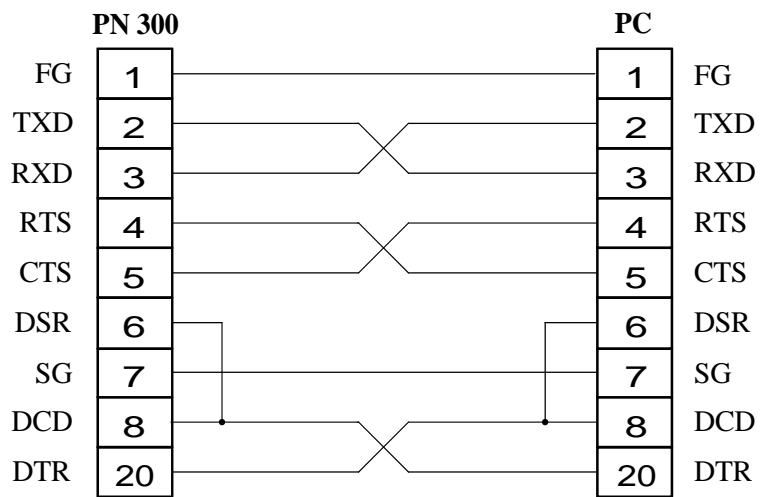
Figure 1: Plug Connections

5 Control Elements
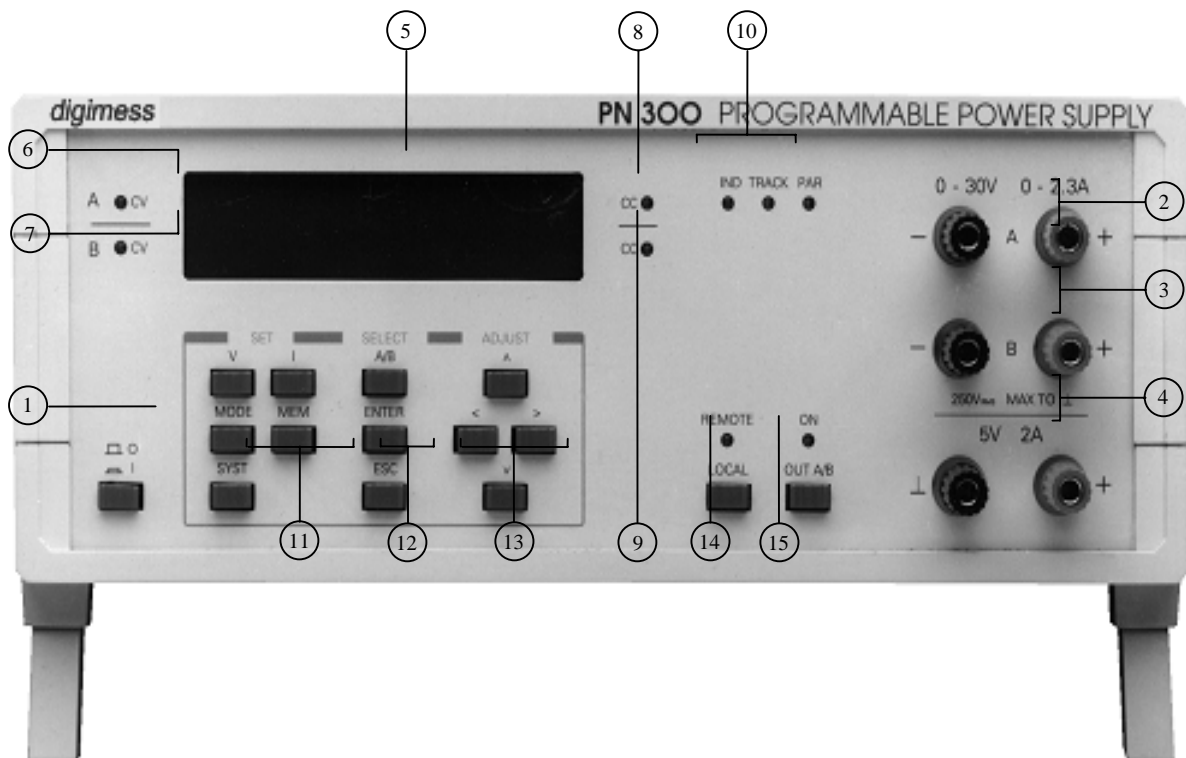
[1]   **Power switch**

[2]   **Output sockets of source A**
        see 4.2.1

[3]   **Output sockets of source B**
        see 4.2.1

[4]   **Output sockets of source C**
        see 4.2.3

[5]   **LC display**
        see 4.4

[6]   **LED *A CV***
        The LED lights up green if source A works as a constant voltage source.
        If the source is used as a constant current source the LED lights up red, signalling that
        the voltage value is out of reach.

[7]   **LED *B CV***

The LED lights up green if source B works as a constant voltage source.
If the source is used as a constant current source the LED lights up red, signalling that the voltage value is out of reach.

[8]   **LED *A CC***
        The LED lights up green if source A works as a constant current source.
        If the source is used as a constant voltage source the LED lights up red, signalling that
        the voltage value is out of reach.

[9]   **LED *B CC***
        The LED lights up green if source B works as a constant current source.
        If the source is used as a constant voltage source the LED lights up red, signalling that
        the voltage value is out of reach.

[10]   **Indication of the operating status**
        The shining LED's signal:

        LED *IND*   - sources A and B work independently,
        LED *TRACK*   - source B tracks the setting parameters of source A,
        LED *PAR*   - parallel connection of sources A and B.

[11]   **Function buttons**
        Pressing the buttons initiates:

        V button   - voltage setting of sources A and B,
        I button   - current setting of sources A and B,
        MODE button   - selection of all the sub-menus,
        MEM button   - saving and loading of the selected parameters,
        SYST button   - configuration of the interfaces GPIB and RS-232C.

[12]   **Select button**
        Pressing the buttons initiates:

        A/B button   - selection of sources A and B,
        ENTER button   - activation of the new parameter settings,
        ESC button   - activation of the previously parameter settings.

[13]   **Cursor buttons**
        The buttons are used for selecting a menu point. Pressing the buttons initiates:

        "∧"   - the menu is scrolled up,
        "<"   - the cursor is moved to the left,
        ">"   - the cursor is moved to the right,
        "∨"   - the menu is scrolled down.

[14]   **LOCAL button**
        On pressing the button the unit switches from remote control to local control. The
        LED *REMOTE* over the button lights up red on remote control.

[15]   **OUT A/B button**
        The button activates or deactivates the outputs of sources A and B. The LED *ON* over
        the button lights up green if the outputs are activated.

The power is supplied by a **fused plug for non-heating appliances**. The PN 300 is protected by a fuse of T 4 AL/250 V for 230 V~ or T 8 AL/250 V for 115 V~ mains voltage respectively. The **operating voltage indication** shows which operating voltage is to be used. The **interfaces GPIB** und **RS-232C** serve the purpose of data transmission on remote via external devices.

The mains plug with fuse, the operating voltage indication, the interfaces and the **type plate of the unit** can be found at the back of the power supply unit.

Note: All buttons are provided with the function *Autorepeat*, i. e. constant pressing causes respective input repetitions.

6 Parameter Settings

6.1 Starting

For external control of the unit the corresponding connecting cable of the system interface GPIB or RS-232C has to be connected before switching on the operating voltage.

After pushing the button Power switch [1] an internal test is started and the following message appears on the display [5]:

```
Testing: UNIT
```

The variable `UNIT` describes the present testing unit. The proper functions of the processor `CPU`, of the `ROM` and `RAM` memory, of the `KEY`board, of the `BATTERY` and `DISPLAY` are tested. If everything is in order, the following message is displayed:

```
Testing: UNIT
.......Passed
```

Otherwise the following message appears on the display:

```
Testing: UNIT
........Error
```

and the unit interrupts the test until the defect is eliminated (not in the case of `Battery Error`).

When the test is successfully completed the previous settings of the RAM are loaded and activated.

In the case of `Battery Error` the following electrical values are set for sources A and B:

```
0.00V    0.001A
0.00V    0.001A
```

After switching on the outputs A and B are always inactivated. All of the settings are indicated via the LED's from [6] to [10].

6.2 Selecting the Operating Mode

6.2.1 Independent Mode of Sources A und B

Sources A and B work independently and can be adjusted separately in this operating mode. After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed and the following message appears on the display [5]:

```
MODE
[ OPERATION    ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE
OPER: [        ]
```

The term in the brackets [ ] describes the current operating mode. On pressing cursor buttons "∧" and "∨" [13] the operating mode INDEPEND is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

6.2.2 Tracking Mode of Source B to the Settings of Source A

Source B is controlled via the parameter inputs of source A in this operating mode. Both sources can be connected in series by connecting the plus socket of one source with the minus socket of the other source. The result will be a maximum voltage of ± 30 V.
After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed and the following message appears on the display [5]:

```
MODE
[ OPERATION    ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE
OPER: [        ]
```

The term in the brackets [ ] describes the current operating mode. On pressing cursor buttons "∧" and "∨" [13] the operating mode A-B TRAC is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

6.2.3 Parallel Mode of Sources A and B

The outputs of sources A and B with the same polarity are connected internally in parallel in this operating mode. Thus, the output is doubled compared to the individual sources.
After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed and the following message appears on the display [5]:

```
MODE
[ OPERATION     ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE
OPER: [         ]
```

The term in the brackets [   ] describes the current operating mode. On pressing cursor buttons "∧" and "∨" [13] the operating mode A-B PAR is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.
All the other parameter inputs are valid for both Sources.

6.3 Function Mode of Sources

6.3.1 Constant Voltage Source

Sources A and B work as a constant voltage source in this functional mode. The output voltage is kept constant during the operation period irrespective of load or temperature deviations.
After pressing the MODE button [11] the sub-menu for setting the operating mode is set. On pressing cursor buttons "∧" and "∨" [13] the menu point for setting the function mode is called and the following message appears on the display [5]:

```
MODE
[ CONTROL      ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE_A
CONT: [         ]
```

The term in the brackets [   ] describes the current function mode. On pressing cursor buttons "∧" and "∨" [13] the function mode CV is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.
The letter A or B behind MODE_ indicates the current source. Sources A and B can be individually addressed using the A/B button [12] in independent operating mode.

6.3.2 Constant Current Source

Sources A and B work as constant current source in this functional mode. The output current is kept constant during the operation period irrespective of load or temperature deviations.

After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed. On pressing cursor buttons "∧" and "∨" [13] the menu point for setting the function mode is called and the following message appears on the display [5]:

```
MODE
[ CONTROL      ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE_A
CONT: [        ]
```

The term in the brackets [ ] describes the current function mode. On pressing cursor buttons "∧" and "∨" [13] the function mode CC is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

The character A or B behind MODE_ indicates the current source. Sources A and B can be individually addressed using the A/B button [12] in independent operating mode.

6.4 Parameter Setting

6.4.1 Mode of Parameter Input

The PN 300 allows the input of voltage and current values in case of active (DIRECT) or inactive (INDIRECT) outputs of sources A and B.

After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed. On pressing cursor buttons "∧" and "∨" [13] the menu point for setting the parameter input mode is called and the following message appears on the display [5]:

```
MODE
[ ADJUSTMENT    ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE
ADJ : [        ]
```

The term in the brackets [ ] describes the current input mode. On pressing cursor buttons "∧" and "∨" [13] the input mode DIRECT or INDIRECT is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

The selection of the input mode DIRECT and the activation of the outputs with the OUT A/B button [15] causes the previously set voltage and current values to appear on the display [5]. Now the cursor blinks at the previously input position. Using the V button, [11], I button [11], A/B button [12] and the cursor buttons [13] the parameters can be consecutively set on the display [5] and at the outputs of sources A [2] and B [3].

The actual output parameters which the instrument internally measures can be called by using the ESC button [20]. Here, no inputs can be made and the cursor does not appear. Only after actuating the V button [11] or I button [11] values can be changed again.

Parameter setting for the input mode INDIRECT is described in the following chapters 6.4.2 and 6.4.3.

6.4.2 Voltage Setting

On pressing the V button [11] the voltage can be set and the following message appears on the display [5]:

```
 VOLTAGE_A                              VOLTAGE_A
 SET :[          ]        or            LIM :[           ]
```

SET is displayed if the current source is used as a constant voltage source. If LIM is displayed, the source works as a constant current source.

The voltage value is indicated in brackets [ ]. It can be changed using the cursor buttons [13]. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

The letter A or B behind VOLTAGE_ indicates the previously set source. Sources A and B can individually be addressed using a A/B button [12] in independent operating mode.

6.4.3 Current Setting

On pressing the I button [11] the current can be set and the following message appears on the display [5]:

```
 CURRENT_A                              CURRENT_A
 SET :[         ]        or             LIM :[          ]
```

SET is indicated if the current source is used as constant current source. In case LIM is indicated, the source works as constant voltage source.

The current value is indicated in brackets [ ]. It can be changed using the cursor buttons [13]. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

The character A or B behind CURRENT_ indicates the previously set source. Sources A and B can individually be addressed using a A/B button [12] in independent operating mode.

6.5 Parameter Control

The voltage and current values of the sources are internally controlled by the instrument. It is possible to choose between two protective functions when the upper or lower limits are exceeded.

After pressing the MODE button [11] the sub-menu for setting the operating mode is accessed. On pressing cursor buttons "∧" and "∨" [13] the menu point for setting the parameter control is called and the following message appears on the display [5]:

```
MODE
[ PROTECTION   ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
MODE
PROT: [        ]
```

The term in the brackets [ ] describes the current protective function. On pressing cursor buttons "∧" and "∨" [13] the protective function LIMITING or CUT-OUT is set. The new setting is saved with the ENTER button [12]. If the former state is to be kept, the ESC button [12] has to be pressed. In both cases the unit reverts to the starting state.

The selection of the protective function LIMITING causes the source working as a constant voltage source automatically to switch to the functional mode of a constant current source whenever the set current value is exceeded. If the source is working as a constant current source, it automatically switches to the functional mode of a constant voltage source whenever the set voltage value is exceeded.

The selection of the protective function CUT-OUT causes the outputs of the sources to be deactivated whenever the upper or lower limits are exceeded. The LED above the OUT A/B button [15] goes out and the following error message appears on the display [5]:

```
Error
Exceeded I limit
```
or
```
Error
Exceeded V limit
```

After changing the limiting values of the source or after changing the output load the outputs of sources A [2] and B [3] can be activated again using OUT A/B button [15]. The input of the limiting values is described in chapter 6.4.

6.6 Parameter Pre-set

The power supply unit PN 300 is provided with an EEPROM allowing five different instrument configurations to be stored. The data are preserved after switching the instrument off.

6.6.1 Storing the Pre-settings

The input of the parameters and functions is set as described in sections 6.2 to 6.5.
After pressing the MEM button [11] the sub-menu for storing and loading the unit settings is set. On pressing cursor buttons "∧" and "∨" [13] the menu point for saving the unit settings is called and the following message appears on the display [5]:

```
MMEM
[ STORE         ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
STORE
SET#: [         ]
```

The term in the brackets [ ] describes the current memory place where the setting are saved. On pressing cursor buttons "∧" and "∨" [13] the desired memory place (#) from 1 to 5 is set and the ENTER button [12] must be pressed. The following query appears on the display:

```
Are you sure ?
```

and the settings can be corrected. If the former state is to be kept, the ESC button [12] has to be pressed. The new setting is saved with the ENTER button [12]. In both cases the unit reverts to the starting state.

6.6.2 Loading the Pre-settings

After pressing the MEM button [11] the sub-menu for storing and loading the unit settings is accessed. On pressing cursor buttons "∧" and "∨" [13] the menu point for loading the unit settings is called and the following message appears on the display [5]:

```
MMEM
[ LOAD          ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
LOAD
SET#: [         ]
```

The term in the brackets [ ] describes the current memory place where the settings are saved. On pressing cursor buttons "∧" and "∨" [13] the desired memory place (#) from 1 to 5 is selected and the ENTER button [12] must be pressed for confirmation. The following query appears on the display:

```
Are you sure ?
```

and the settings can be corrected. If the former state is to be kept, the ESC button [12] has to be pressed. The new settings are loaded with the ENTER button [12]. In both cases the unit reverts to the starting state.

6.7 Error Messages

During the operation of the sources errors can occur owing to wrong connecting conditions or internal problems. The corresponding message is indicated on the display [5]:

```
  Warning
  Unit overheated
```
- overheating of the instrument

```
  Error
  Load failed
```
- error on loading stored pre-settings

```
  Error
  Exceeded I limit
```
- upper limit of set current exceeded

```
  Error
  Exceeded V limit
```
- lower limit of set voltage exceeded

7 Remote Control by Program

Remote control of the power supply unit by a PC is possible via the interfaces GPIB and RS-232C. The serial connecting cable must not be longer than 15 m. Interface cables should be connected when the unit is off. After switching on the power supply unit is in starting position and can receive commands. The remote control is displayed on LED *REMOTE* [14].

7.1 Preparing the Power Supply Unit

7.1.1 Interface GPIB (IEEE-488.2)

The connecting cable between the power supply unit and the PC must correspond to standard IEEE-488.2. The interface GPIB of the power supply unit is set at the system address 7.
After switching on the unit and when the internal test is successfully completed the transmission parameters can be set with the help of a menu.
After pressing the SYST button [11] the sub-menu is called and the following message appears on the display [5]:

```
SYSTEM
[ INTERFACE    ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
INTERFACE
SEL : [  GPIB  ]
```

On pressing cursor buttons "∧" and "∨" [13] the desired interface GPIB or RS 232C is set. The new setting GPIB is saved with the ENTER button [12] and the following message appears on the display [5]:

```
GPIB
ADDR: [  7     ]
```

On pressing cursor buttons "∧" and "∨" [13] the system address can be changed. With the help of the ENTER button [12] the current address is saved and the settings are finished.
After switching off the settings are saved.

7.1.2 Interface RS-232C

The interface RS-232C of the PC must have the configuration as described in paragraph 4.4.2. After switching on the unit and when the internal test is successfully completed the transmission parameters can be set with the help of a menu.
After pressing the SYST button [11] the sub-menu is called and the following message appears on the display [5]:

```
SYSTEM
[ INTERFACE    ]
```

With the help of the ENTER button [12] the menu point is confirmed and the following message is displayed:

```
INTERFACE
SEL : [RS 232C]
```

On pressing cursor buttons "∧" and "∨" [13] the desired interface GPIB or RS 232C is set. The new setting RS 232C is saved with the ENTER button [12] and the following message appears on the display [5]:

```
RS 232C
RATE:  [24ØØ Bd]
```

On pressing cursor buttons "∧" and "∨" [13] the selected transmission rate from 12ØØ Bd to 96ØØ Bd is set. The new setting is saved with the ENTER button [12] and the following message appears on the display [5]:

```
RS 232C
PROT:  [RTS/CTS]
```

On pressing cursor buttons "∧" and "∨" [13] the communication protocol can be changed. With the help of the ENTER button [12] the current protocol is saved and the settings are finished.
After switching off the settings are saved.

7.2 Transition: Remote Control ⇔ Local Control

On transmission of the command REN from the personal computer the power supply unit is in the state of REMOTE CONTROL which is indicated by the LED *REMOTE* [14]. Afterwards control of the unit by the local control elements is not possible (except LOCAL button [14]). On changing to remote control the outputs of sources A and B are deactivated.

There are several ways of switching from remote control to local control of the unit:
- by transmission of the command GTL (Go To Local) from the PC,
- by pressing the LOCAL button [14] on the power supply unit if the unit keyboard has not been locked by the command LLO (Local Lock Out),
- by switching off and on the power switch [1].

The following enquires and instructions can be transmitted and received by the PC even when the unit is on local control:

        *IDN?,*CLS,*ESR?,*ESE,*ESE?,*STB?,*SRE,*SRE?,ERR?,DER?.

7.3 Messages of the Power Supply Unit on Remote Control

7.3.1 Description of the Unit State

The current status of the unit's operating conditions can be indicated via the EVENT STATUS REGISTER and the STATUS BYTE REGISTER at any time.

7.3.1.1 ESR - EVENT STATUS REGISTER

The contents of the ESR register are saved in the output buffer and deleted by transmission of the command `*ESR?` from the PC. The ESR register can also be set on Ø (except bit 7) by switching on the unit, by transmitting the command `*CLS` or after activation of the interface GPIB.

Contents of the ESR register: `ESR xxx`

Bit **7**: (PON) Power On, operating readiness and activation of the interfaces are displayed on `1`.
 6: (URQ) User Request, is not used, is always set on Ø.
 5: (CME) Command Error, is set on `1` in the event of instruction errors.
 4: (EXE) Execution Error, is set on `1` in the event of request errors and execution errors.
 3: (DDE) Device Dependent Error, unit errors are displayed on `1`.
 2: (QYE) Query Error, is set on `1` at request errors.
 1: (RQC) Request Control, is not used, is always set on Ø.
 Ø: (OPC) Operation Complete, is set on `1` by transmission of the command `*OPC`.

Various states and settings of the unit can be checked. For this the contents of the ESR register are called with the help of a mask (ESE - EVENT STATUS ENABLE REGISTER). The single bits are compared and evaluated by the following logical equation:

$$ESB = (ESR7 \wedge ESE7) \vee (ESR6 \wedge ESE6) \vee (ESR5 \wedge ESE5) \vee (ESR4 \wedge ESE4) \vee$$
$$(ESR3 \wedge ESE3) \vee (ESR2 \wedge ESE2) \vee (ESR1 \wedge ESE1) \vee (ESRØ \wedge ESEØ)$$

The result ESB (Event Summary Bit) is saved in the STB register.
The command `*ESE xxx` offers the possibility of initializing the ESE register with any mask. The value `xxx` has to be within the range of Ø to `255`.
The current contents `xxx` are in the output buffer after transmitting the command `*ESE?`. The contents of the register can set on Ø (except bit 7) by switching on the unit, by transmitting the command `*CLS` or after activating the interface GPIB.

7.3.1.2 STB - STATUS BYTE REGISTER

The contents of the STB register are saved in the output buffer by transmission of the command `*STB?`. The STB register can be set on Ø by switching on the unit, by transmitting of the command `*CLS` or after activating the interface GPIB.

Contents of the STB register: `STB xxx`

Bit **7**: is not used, is always set on Ø.
    6: (MSS) Master Summary Bit, result by checking of the STB register with a mask (SRE register, see below).
(RQS) Request service, for GPIB interface only, is derived from the condition of the MSS bit according to IEEE-488.2 and is read as part of the STB register by transmission of the command `*STB?` in serial operating mode according to IEEE-488.1.
    5: (ESB) Event Summary Bit, result by checking of the ESR register with a mask (ESE register).
    4: (MAV) Message Available, is set on `1` if a current massage of the unit is requested at the output buffer.
    3: is not used, is always set on Ø.
    2: is not used, is always set on Ø.
    1: is not used, is always set on Ø.
    Ø: is not used, is always set on Ø.

Note: When the interface GPIB is used in serial operating mode according to IEEE-488.1 the RQS bit is readable as the part of the STB register for the PC. This option does not exist when using interface RS-232C.

Various states and settings of the unit can be checked. For this the contents of the ESR register are called with the help of mask (SRE - SERVICE REQUEST ENABLE REGISTER). The single bits (except SRE bit 6, it is set on Ø always) are compared and evaluated by the following logical equation:

$$MSS = (STB7 \wedge SRE7) \vee (STB5 \wedge SRE5) \vee (STB4 \wedge SRE4) \vee (STB3 \wedge SRE3) \vee$$
$$(STB2 \wedge SRE2) \vee (STB1 \wedge SRE1) \vee (STBØ \wedge SREØ)$$

The result MSS (Master Summary Status) is saved in the STB register.
The command `*SRE xxx` offers the possibility of initializing the ESE register with any mask. The value `xxx` has to be within the range of Ø to `255`.
The current contents `xxx` are in the output buffer after transmitting the command `*SRE?`. The contents of the register can be set on Ø by switching on the unit, by transmitting the command `*CLS` or after activating the interface GPIB.

7.3.2 Description of Results

The measuring results are sent in the following format:

    numeric argument of data: from   `x` to   `vxx`
    voltage values: from `x.xx` to `zx.xx`
    current values: `u.xxx`

where:
    `x`   · characters from Ø to 9
    `v`   · characters from Ø to 2
    `z`   · characters from 1 to 3
    `u`   · characters from Ø to 4

7.3.3 Description of Errors

When errors occur in the remote-controlled settings and measurements, they are saved with a code in the error register. The contents (error message) of the error register can be called and deleted at any time by transmission of the command ERR?.
If several errors arise only the first two error codes are saved. On repeating transmission of the command ERR? the contents of the error codes are saved in the output buffer and initialized (deleted). The initializing of the error register is also started by transmission of the command *CLS (initializing of the state register).

Note: Inappropriate transmission of the ERR? command may cause errors. For this reason the interface command DCL should be transmitted before the ERR? command is transmitted.

7.3.3.1 DER - DEVICE ERROR REGISTER

The contents of the DER register are saved in the output buffer by transmission of the command DER?.

Contents of the DER register: DER xxx

   Bit **7**: is set on 1 when the unit is overheated.
       6: is set on 1 during reading of the selection register.
       5: (BCC) is set on 1 when the current limit of source B is exceeded.
       4: (BCV) is set on 1 when the voltage limit of source B is exceeded.
       3: is not used, is always set on Ø.
       2: is not used, is always set on Ø.
       1: (ACC) is set on 1 when the current limit of source A is exceeded.
       Ø: (ACV) is set on 1 when the voltage limit of source A is exceeded.

7.3.3.2 Error Messages

The error messages are dependent on the operating state and the type of the error.
On local control interface errors are displayed for only a short time. On remote control interface errors are displayed until the contents of the error register are queried or initialized.
Unit errors are displayed until new commands from the PC are transmitted.

List of error messages:

Error Code	Text of Messages	Meaning of Text
Ø	–	- faultless operation
	DEVICE ERROR	**device error**
	DEVICE DEPENDENT ERROR	**error of the unit functions**
21	EXCEEDED I LIMIT	- current limit is exceeded
22	EXCEEDED V LIMIT	- voltage limit is exceeded
91	UNIT OVERHEATED	- unit is overheated
96	LOAD FAILED	- error during reading the selection register
	INTERFACE ERROR	**interface error**
	QUERY ERROR	**query error**
111	UNDERMINATED	- interface isn't programmed, read operation
114	INTERRUPTED	- interface is programmed, no read operation
117	DEADLOCKED	- interface is programmed, locked
12Ø	BAD USING QUERY	- query is wrong
	EXECUTION ERROR	**execution error**
132	NOT EX. IN LOCAL	- cannot be executed in local control
134	VAL. OUT OF RANGE	- values are out of range
	COMMAND ERROR	**command error**
151	ILLEGAL COMMAND	- illegal command
	RS 232 ERROR	**error of the RS-232C interface**
181	INP. BUFFER FULL	- input buffer is full

Note: If protective mode LIMITING is set the error messages 21 und 22 are not displayed. In this case the error is signalled via the LED's [6, 7, 8, 9] (see 5).

7.4 List of Commands on Remote Control

7.4.1 General Commands

REN (Remote)   - transition from local control to remote control
                   GPIB: - address instruction according to IEEE-488.1
                   RS-232C: - ASCII: HT = 9 (dec.)

LLO (Local Lockout)   - locking of the LOCAL button
                   GPIB: - address instruction according to IEEE-488.1
                   RS-232C: - ASCII: EM = 25 (dec.)

GTL (Go To Local)   - transition from remote control to local control
                   GPIB: - address instruction according to IEEE-488.1
                   RS-232C: - ASCII: SOH = 1 (dec.)

`DCL` (Device clear)   - initializing for the communication protocol of the interface
                 GPIB: - address instruction according to IEEE-488.1
                 RS-232C:- ASCII: `DC4` = 20 (dec.)

        Note: This command must not stand between the first command and the end
                 character of a command line.

`*RST` (Reset)   - initializing of unit settings of sources A and B
                 outputs: - disabled
                 operating mode: - `INDEPEND` (Independent Mode)
                 function mode: - `CV` (constant voltage source)
                 output voltages: - `Ø.ØØ V`
                 output currents: - `2.3ØØ A`
                 protective function: - `LIMITING`

        Note: After switching on the settings are loaded. Furthermore the commands
                 `DCL`, `*CLS` and `OUT_OFF` are executed automatically and the contents
                 of the ESE and SRE register are reset. The bit 7 (PON) of the ESR
                 register is set on 1.

`*TST?` (Test)   - start of unit tests and saving of results
                 meaning: Ø - test is successful
                         1 - test is not successful

`*IDN?` (Identification)   - identification `GRUNDIG,PN3ØØ,x,y`
                 with `x` - production number or Ø
                      `y` - software version or Ø

        Note: The command `*IDN?` must be written at the end of the command line
                 so that the result is saved in the output buffer.

`*CLS`
(Clear Status Byte)   - initializing (resetting) of ESR, STB and ERR register

`ERR?` (Error)   - reading and resetting of the error messages (see 7.3.3)
`DER?`   - Contents of the DER register are saved in the output buffer.

`*WAI` (Waiting)   - The following commands are executed after completion of
                 current operation.
`*OPC`
(Operation Complete)   - After completion of current operation the bit 7 (OPC) in the
                 ESR register is set on 1.
`*OPC?`   - After completion of current operation the number 1 is saved in
                 the output buffer.

`*ESR?; *ESE xxx; *ESE?`   - reading and setting of the ESR (see 7.3.1.1)
`*STB?; *SRE xxx; *SRE?`   - reading and setting of the STB (see 7.3.1.2)

7.4.2 Commands and Messages

Setting the operating mode of sources A and B (see 6.2)

OPER_IND	- setting of the operating mode INDEPEND (Independent Mode)
OPER_TRAC	- setting of the operating mode A-B TRAC (Tracking Mode)
OPER_PAR	- setting of the operating mode A-B PAR (Parallel Mode)
OPER?	- Current operating mode OPER_IND, OPER_TRAC or OPER_PAR is saved in the output buffer.

Selecting the sources for the following settings

SEL_A	- selection of source A
SEL_B	- selection of source B
SEL?	- Current selection SEL_A or SEL_B sources A and B is saved in the output buffer.

Setting the function mode of sources A and B (see 6.3)

CONT_CV	- the source works off a constant voltage source
CONT_CC	- the source works off a constant current source
CONT?	- Current selection CONT_CV or CONT_CC of the function mode is saved in the output buffer.

Voltage setting of the selected source

VSET xxxxx	- voltage setting in the range (xxxxx) from $\varnothing.\varnothing\varnothing$ to $3\varnothing.\varnothing\varnothing$
VSET_MIN	- voltage setting on $\varnothing.\varnothing\varnothing$ V
VSET_MAX	- voltage setting on $3\varnothing.\varnothing\varnothing$ V
VSET?	- Voltage setting V xxxxx is saved in the output buffer.
VOUT?	- Measured voltage value V xxxxx is saved in the output buffer.

> Note: When the selected source works off a constant current source and the command VSET? is transmitted, the displayed voltage represents the value of voltage limit.

Current setting of the selected source

ISET xxxxx	- current setting in the range (xxxxx)
	a) from $\varnothing.\varnothing\varnothing1$ to $2.3\varnothing\varnothing$ for the operating mode INDEPEND and A-B TRAC
	b) from $\varnothing.3\varnothing\varnothing$ to $4.6\varnothing\varnothing$ for the operating mode A-B PAR
ISET_MIN	- current setting to
	a) $\varnothing.\varnothing\varnothing1$ A for the operating mode INDEPEND and A-B TRAC
	b) $\varnothing.3\varnothing\varnothing$ A for the operating mode A-B PAR

```
ISET_MAX            - current setting to
                        a) 2.3ØØ A for the operating mode INDEPEND and A-B TRAC
                        b) 4.6ØØ A for the operating mode A-B PAR
ISET?               - Current setting A xxxxx is saved in the output buffer.
IOUT?               - Measured current value A xxxxx is saved in the output buffer.
```

> Note: When the selected source works off a constant voltage source and the command ISET? is transmitted, the displayed current represents the value of current limit.

Activation of source outputs A and B

```
OUT_ON              - Outputs of sources A und B are active.
OUT_OFF             - Outputs of sources A und B are not active.
OUT?                - Current state OUT_ON or OUT_OFF of source outputs A and B is
                      saved in the output buffer.
```

Parameter control of sources A and B (see 6.5)

```
PROT_LIM            - setting of the protective function LIMITING
PROT_CUT            - setting of the protective function CUT-OUT
PROT?               - Current protective function PROT_LIM or PROT_CUT of sources A
                      and B is saved in the output buffer.
```

Saving and loading of parameter pre-set

```
*SAV x              - saving of parameters at the memory places (x) from Ø to 5
*RCL x              - loading of parameters at the memory places (x) from Ø to 5
```

7.5 Measurement by Remote Control

For external control of the unit the respective connecting cable of the system interface GPIB or RS-232C has to be connected before switching on the operating voltage. After switching on the power supply unit is in starting position and can receive commands. The remote control is displayed on LED *REMOTE* [14].

It should be noted that single commands or groups of commands have to be separated by a semicolon (ASCII: ";" = 59) and ended by the end character. Certain commands or messages can contain parameters or measuring results which are clarified by a separation character.

Single commands can be written one after the other in one command line, the length of which may not exceed 64 characters. In case errors occur, the command sequence is ignored and error INP. BUFFER FULL is indicated.

Separation and end characters for transmission of commands:

ASCII	GBIP	RS-232C
Separation characters	SP = 32 (dec.) NUL to HT = 0 to 9 (dec.) VT to US = 11 to 31 (dec.)	SP = 32 (dec.)
End characters	LF = 10 (dec.) LF = 10 (dec.) + END (EOI true) last character of the command + END (EOI true)	LF = 10 (dec.)

Separation and end characters for receiving messages:

ASCII	GBIP	RS-232C
Separation characters	SP = 32 (dec.)	SP = 32 (dec.)
End characters	LF = 10 (dec.) + END (EOI true)	CR + LF = 13 + 10 (dec.)

7.6 Program Examples (Q-Basic)

```
100 REM *************************************************
110 REM     THE EXAMPLE OF USING PN 300 WITH GPIB-INTERFACE
120 REM          AT-GPIB/TNT AND SOFTWARE NI-488.2 OF NI
130 REM           VOLTAGE SETTING OF SOURCE A TO 10.00 V
140 REM           VOLTAGE SETTING OF SOURCE B TO 30.00 V
150 REM         CURRENT SETTING OF BOTH SOURCES TO 0.100 A
160 REM               ITS GPIB SYSTEM ADDRESS IS 7
170 REM          EXAMPLE PROGRAM USING NI-488.2 SUBROUTINES
180 REM  MERGE THIS CODE WITH DECL.BAS (WHEN USING NI-488.2)
190 REM *************************************************
200 REM
210 REM          *** SET UP INTERFACE AT-GPIB/TNT ***
220     DIM ADDRLIST%(31):ADDRLIST%(0)=7:ADDRLIST%(1)=NOADDR%
230     BDINDEX%=0: PAD%=7
240     CALL SENDIFC(BDINDEX%)
250 REM
260 REM      *** SET UP INTERFACE AND STATUS REPORTING ***
270     CALL ENABLEREMOTE (BDINDEX%,ADDRLIST%(0))
280     CALL DEVCLEAR(BDINDEX%,PAD%)
290     WRT$="*RST;*CLS"
300     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
310 REM
320 REM          *** SETTING OF OPERATING PARAMETERS ***
330     WRT$="OPER_IND;PROT_LIM"
340     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
350 REM
360 REM            *** SETTING OF SOURCE A ***
370     WRT$="SEL_A;VSET 10.00;ISET 0.100"
380     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
390 REM
400 REM            *** SETTING OF SOURCE B ***
410     WRT$="SEL_A;VSET_MAX;ISET 0.100"
420     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
430 REM
440 REM            *** ACTIVATION OF OUTPUTS ***
450     WRT$="OUT_ON"
460     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
470 REM
480 REM      *** SET UP DEVICE AND SET LOCAL MODE ***
490     WRT$="*OPC?"
500     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
510     RD$= SPACE$(20)
520     CALL RECEIVE (BDINDEX%,PAD%,RD$,STOPEND%)
530 REM
540     CALL ENABLELOCAL (BDINDEX%,ADDRLIST%(0))
550 REM
560 REM      *** DISABLE THE SOFTWARE AND HARDWARE ***
570     V% = 0
580     CALL IBONL (BDIDEX%,V%)
590     END
```

```
5    REM **********************************************
1Ø   REM   THE EXAMPLE OF USING PN 3ØØ WITH RS-232C INTERFACE
2Ø   REM        VOLTAGE SETTING OF SOURCE A TO 1Ø.ØØ V
3Ø   REM        VOLTAGE SETTING OF SOURCE B TO 3Ø.ØØ V
4Ø   REM       CURRENT SETTING OF BOTH SOURCES TO Ø.1ØØ A
5Ø   REM **********************************************
6Ø   CLS
7Ø   REM          *** SET UP INTERFACE COMMANDS ***
8Ø      IDCL$=CHR$(2Ø):IREN$=CHR$(9):ILLO$=CHR$(25): IGTL$=CHR$(1)
9Ø   REM
1ØØ  REM          *** OPENING COMMUNICATION FILE ***
11Ø     OPEN "com2:12ØØ,n,8,1,CS3ØØØØ,LF" FOR RANDOM AS #1
12Ø  REM
13Ø  REM       *** SET UP DEVICE AND STATUS REPORTING ***
14Ø     PRINT #1,IDCL$;IREN$;ILLO$;"*RST;*CLS"
15Ø  REM
16Ø  REM          *** SETTING OF OPERATING PARAMETERS ***
17Ø     PRINT #1,"OPER_IND;PROT_LIM"
18Ø  REM
19Ø  REM             *** SETTING OF SOURCE A ***
2ØØ     PRINT #1,"SEL_A;VSET 1Ø.ØØ;ISET Ø.1ØØ"
21Ø  REM
22Ø  REM             *** SETTING OF SOURCE B ***
23Ø     PRINT #1,"SEL_A;VSE_MAX;ISET Ø.1ØØ"
24Ø  REM
25Ø  REM           *** ACTIVATION OF OUTPUTS ***
26Ø     PRINT #1,"OUT_ON"
27Ø  REM
28Ø  REM       *** SET UP DEVICE AND SET LOCAL MODE ***
29Ø     PRINT #1,"*RST;*OPC?"
3ØØ  REM #1 ,A$
31Ø     PRINT #1,IGTL$
32Ø  REM
33Ø  REM               *** CLOSE STATEMENT ***
34Ø     CLOSE #1
35Ø  END
```

8 Maintenance

The unit does not require special maintenance if it is used and handled correctly. Only use a soft wet rag with some soap-suds or a soft rinse liquid for cleaning. Avoid acrid cleanser and solvents.
Service work should only be done by trained personnel.
In case of repairs it is vital to ensure that the design characteristics of the unit are not changed thus reducing the safety and that replacement parts match the original ones and are installed properly (original state).

⚠ **Warning!**   The unit must be separated from all power sources before maintenance
                     work, repairing or replacing parts or fuses.

9 Appendix

9.1 Declaration of Conformity

	Konformitätserklärung	
digimess	Declaration of Conformity / Déclaration de Conformité 132/**95**	**CE**

Der Hersteller/Importeur
The manufacturer/importer
Le producteur/importateur

digimess
Professional Electronics GmbH

Anschrift / Address / Adresse

Würzburger Straße 150
90766 Fürth
Germany

erklärt hiermit eigenverantwortlich, daß das Produkt:
hereby declares, that the product: / déclare, que le produit:

Bezeichnung / Name / Description

Programmierbares Netzteil
Programmable Power Supply
Bloc d'alimentation programmable

Type / Model / Type

PN 300

Bestell-Nr. / Order-No. / Nº de réf.

H.UC 40-00

folgenden Normen entspricht:
is in accordance with the following specifications: / correspond aux normes suivantes:

EN 61010-1 (1994)

DIN EN 50081-1 (1993)DIN EN 50081-2 (1994)

EN 55011 (1991) Class B

EN 55022 (1987) Class B

IEC 801-2 (1991) / prEN 55024-2 (1992) 2 kV

IEC 801-4 (1988) / prEN 55024-4 (1993) 1 kV Burst

IEC 801-3 (1984)   3V/m ; 0,15-150 MHz

Das Produkt erfüllt somit die Forderungen folgender EG-Richtlinien:
Therefore the product fulfils the demands of the following EC-Directives:
Le produit satisfait ainsi aux conditions des directives suivantes de la CE:

73/23/EWG **Richtlinie betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen**
Directive relating to electrical equipment designed for use within certain voltage limits
Directive relatives au matériel électrique destiné à être employé dans certaines limites de tension

89/336/EWG **Richtlinie über die elektromagnetische Verträglichkeit**
Directive relating to electromagnetic compatibility
Directive relatives à la compatibilité électromagnétique

Fürth, 4.8.1995

Henninger
Leiter Qualitätsmanagement
Q-Manager / Directeur Contrôle de Qualité