Operating Instructions

GOSSEN METRAWATT
GMC-INSTRUMENTS GROUP

# SYSKON | P500, P800, P1500, P3000 und P4500
# Computer Controlled Laboratory Power Supplies

3-349-373-03
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## Contents Page



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☞ **Note**
These operating instructions describe devices as from firmware version 005, see chap. 2.4.1.

# 1 Initial Inspection – Exclusion of Liability – Warnings

When unpacking the instrument, make sure that the KONSTANTER and all included accessories are fully intact and have not been damaged during transport.

### Unpacking

- Other than the usual care exercised in handling electronic equipment, no additional precautions are required when unpacking the instrument.
- The KONSTANTER is delivered in recyclable packaging, which provides for adequate protection during transport as substantiated by testing. If the instrument is repacked at a later point in time, the same packaging or its equivalent must be used.

### Visual Inspection

- Compare the order number or type designation included on the packaging and/or the serial plate with the particulars shown in the shipping documents.
- Make sure that all accessory components have been included (see chap. 14, “Order Information”).
- Inspect the packaging, as well as mechanical instrument and accessory components for possible transport damage.

### Complaints

If damage is discovered, immediately file a claim with the freight forwarder (save the packaging!). If other defects are detected or in the event that service is required, inform your local representative, or contact us directly at the address included in the last page of this handbook.

### Use for Intended Purpose

Use of the KONSTANTER for its intended purpose is only fulfilled if the instrument is used in accordance with the stipulations set forth in the respective operating instructions, and is operated within the specified power limits. The Konstanter may only be used by persons with appropriate technical knowledge, or who have received appropriate instruction.

In order to prevent danger during use, shock-proof connector cables must be used when connecting power consumers. The KONSTANTER’s output values (U, I) must be adjusted such that no danger of overloading or destruction exists for the connected power consumer.

Only then can the safety of the user, the instrument and the device under test or the power consumer be assured.

### Exclusion of Liability

This product is not intended for use in applications such as nuclear facilities, aircraft safety and navigation, weapons systems, life support systems or any other systems whose failure or malfunctioning could result in property damage, environmental damage or personal injury of any kind or magnitude. The user agrees that Embarcadero shall not be liable for any damages arising out of such use of the product, and that the user shall bear sole responsibility for any costs, losses, personal injuries or property damage incurred as a result of such use.

### Warnings and Safety Precautions

The KONSTANTER has been manufactured and tested in accordance with the electrical safety regulations listed under Technical Data as a protection category I device, and has been shipped from the factory in flawless technical safety condition. In order to maintain this condition and to assure safe operation, users must observe all notes and warnings included in these operating instructions.

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**Attention!**

A note concerning operation, practical advice or other information which must be adhered to in order to prevent damage to the **KONSTANTER**, and to assure correct operation.

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**WARNING!**

An operating procedure, practical advice or other information which must be adhered in order to assure safe operation of the **KONSTANTER**, and to prevent personal injury.
The most important warnings are summarized below.

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**WARNING!**

**Protective Grounding, PE Connection**
The KONSTANTER may only be placed into operation after the protective conductor has been connected. Interruption or disconnection of the protective conductor may result in danger for the user.
The device is connected to the mains by means of a 3 conductor cable with mains plug.

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**WARNING!**

**Opening the Housing Covers**
Remove the mains plug from the outlet before opening the housing. When the housing covers are opened, voltage conducting parts may be exposed.
Any contact with these exposed conductive parts is life endangering.
For this reason, the instrument may only be opened by trained personnel who are familiar with the dangers involved.

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**WARNING!**

**Repair by Trained Personnel**
Maintenance and repair work, as well as internal balancing, may only be performed by trained personnel who are familiar with the respective functions, and the dangers involved.
After the instrument has been disconnected from the mains, wait approximately 5 minutes in order to allow the capacitors to discharge themselves to safe voltage levels.

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**WARNING!**

**Replacing Fuses**
Only the specified fuse types with the specified nominal current ratings may be used to replace blown fuses (see Technical Data and specifications on the serial plate).
Manipulation of the fuses and/or the fuse holder is prohibited.

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**Attention!**

**Impaired Safety**

If it can be assumed that safe operation is no longer possible, the KONSTANTER must be removed from service and secured against inadvertent use. Safe operation is no longer possible:

– If the KONSTANTER demonstrates visible damage or transport damage
– If the KONSTANTER no longer functions
– After lengthy periods of storage under conditions which deviate from specified storage conditions

**Meanings of Symbols**

CE European conformity marking

This instrument fulfills all requirements of applicable European and national EC directives. We confirm this with the CE mark. The relevant declaration of conformity can be obtained from Gossen Metrawatt GmbH.

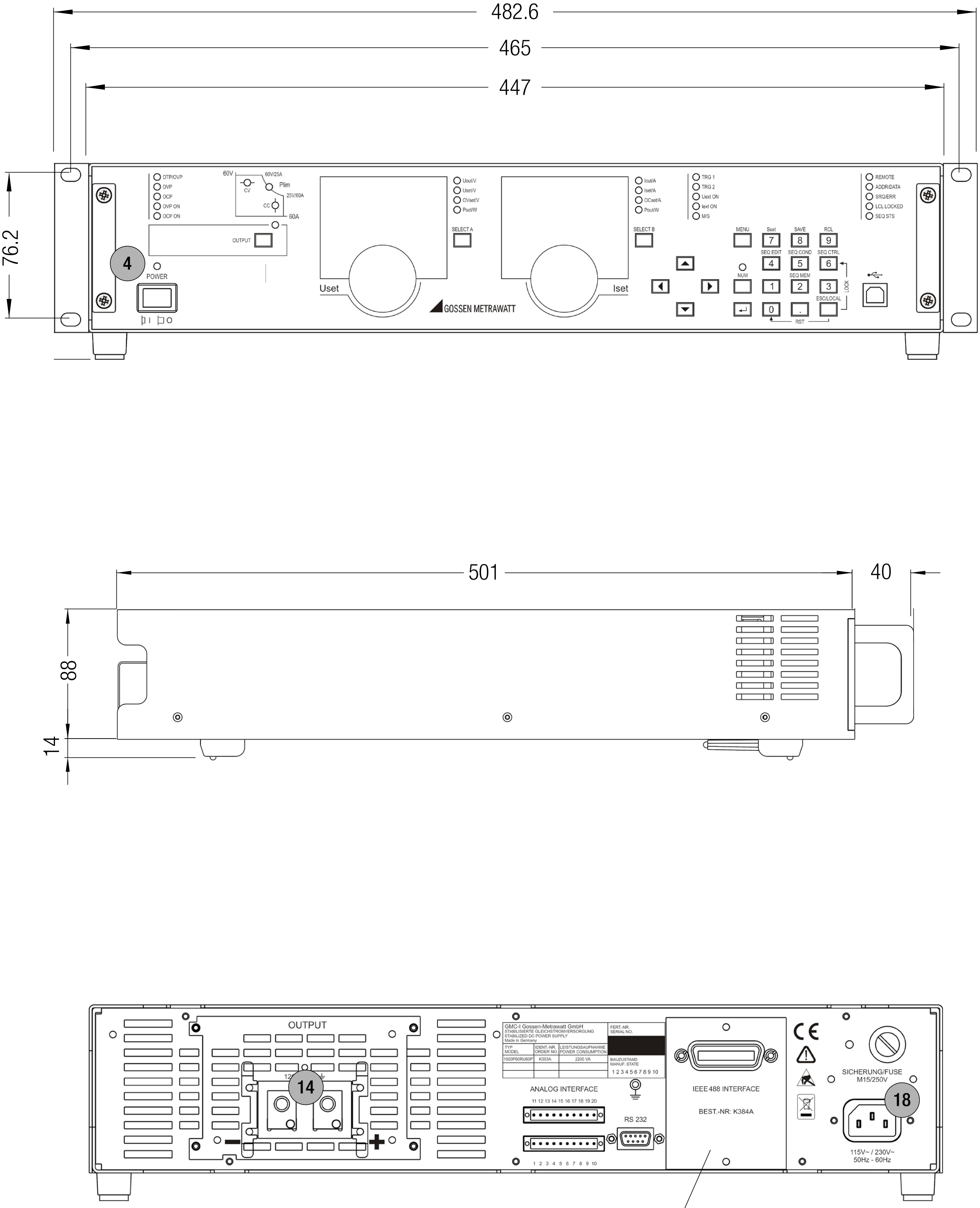
Observe ESDS directives

Warning concerning a point of danger (attention, observe documentation!)

The device may not be disposed of with household trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term "WEEE".

# 2 Initial Startup – Dimensional Drawings

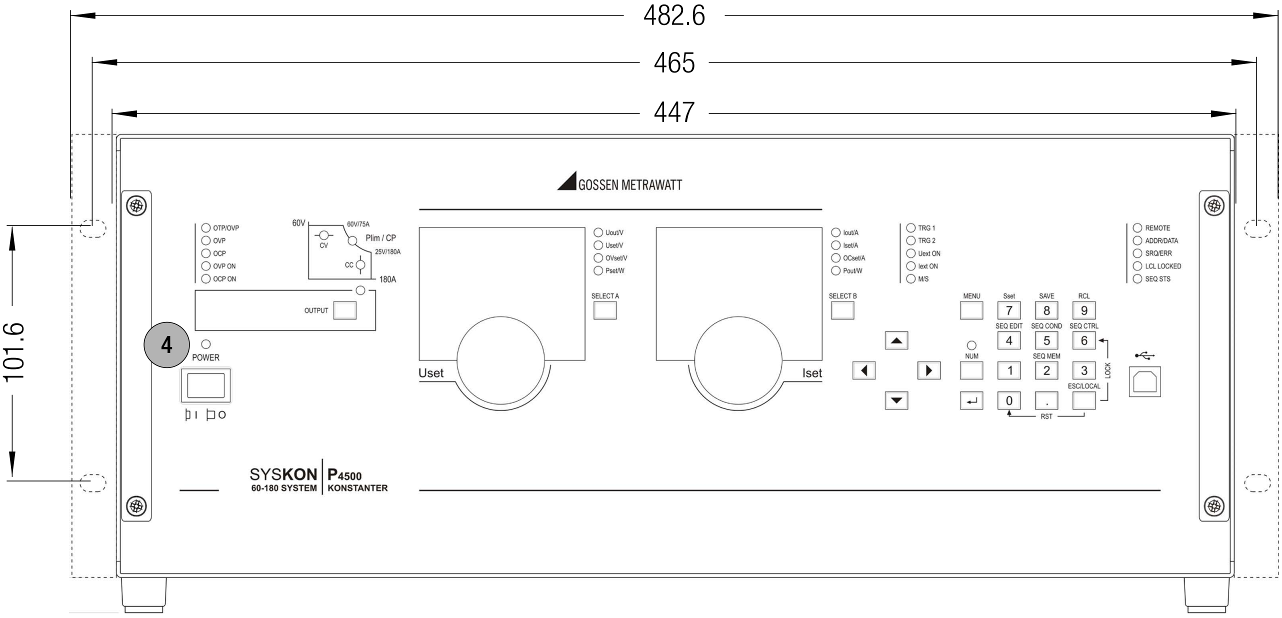
## 2.1 Dimensional Drawing, SYSKON P500 / P800 / P1500

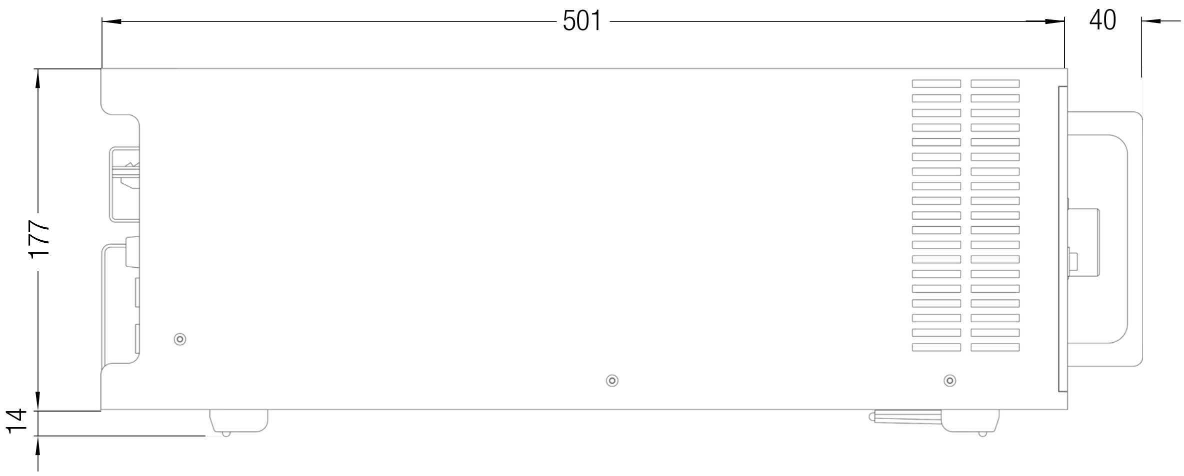


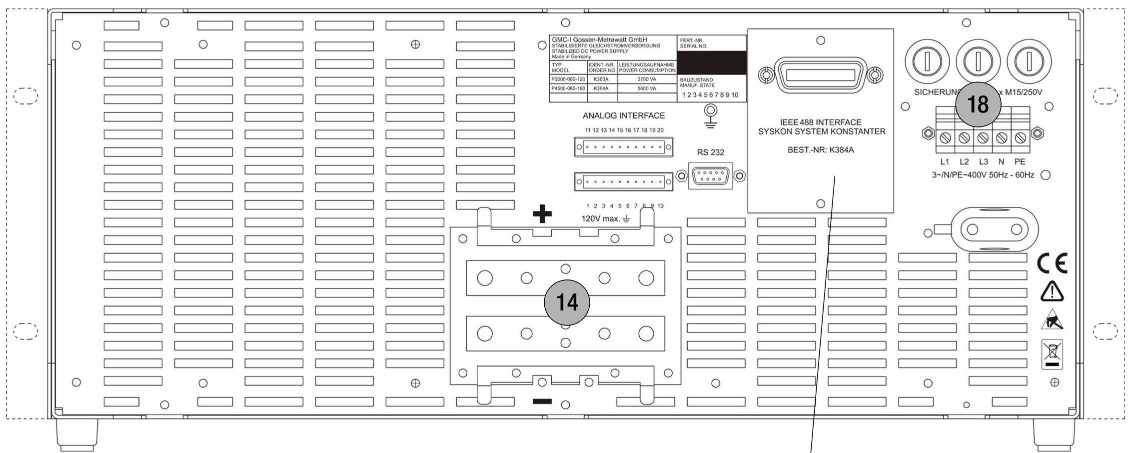

Installation position for optional IEEE-488 interface (material no. K384A).

All dimensions in mm

## 2.2 Dimensional Drawing, SYSKON P3000 / P4500




Installation position for optional IEEE-488 interface (material no. K384A).

All dimensions in mm

## 2.3 Preparing for Operation

Note: Numbers in brackets make reference to the items listed in the dimensional drawing.

### 2.3.1 Installing the Optional GPIB Interface Module

**WARNING !**

The device must be switched off when installing the interface module. **Remove the mains plug from the outlet.** The interface module may be damaged by electrostatic discharge. ESDS handling guidelines must be adhered to. Do not touch electrical contacts or components.

1. Unscrew the cover plate at the right-hand side of the rear housing panel.
2. Carefully remove the ribbon cable from the cable holder and plug it in, being certain to observe coding as shown on the interface module.
3. Carefully insert the connected module into the opening and secure it with the previously removed cover plate screws.

### 2.3.2 Setup as Benchtop Device

The instrument is shipped as a benchtop device and the feet are already installed. The mounting tabs for installation to a 19" rack are shipped loose. The instrument can be set up as a benchtop device and placed into operation. Unimpaired ventilation of the instrument must be assured during setup.

### 2.3.3 Installation to a 19'' Device Rack

The SYSKON KONSTANTER housing allows for use as a benchtop instrument, as well as for installation to a 19'' rack.

The benchtop instrument can be quickly converted to a rack mount device:

1. Unscrew the handles at the front.
2. Pull out the filler strips at the sides and replace them with the included rack-mount fastening tabs.
3. Replace the front handles (if you prefer not to use the handles, turn M4 screws with a maximum length of 8 mm into the empty threaded holes.)
4. Unscrew the feet from the bottom of the housing.
5. Save all loose parts for possible future use.

**Attention !**

The instrument must be attached at both sides to guide rails inside the device cabinet. The guide rails, as well as the front panel mounting screws, are cabinet-specific and must be procured from your rack supplier.

### 2.3.4 Connection to the Mains

**WARNING !**

**Protective Grounding, PE Connection**
The KONSTANTER may only be placed into operation after the protective conductor has been connected. Interruption or disconnection of the protective conductor may result in danger for the user.
The device is connected to the mains by means of a 3-conductor cable with mains plug.

**Attention !**

Before switching the SYSKON KONSTANTER on, it must be assured that available mains power complies with the supply power values specified at the mains connection on the back of the device.

**SYSKON P500/P800/P1500:** The device can be operated with either 115 or 230 V mains power. Full output power of 1500 W can be taken advantage of when operated with 230 V mains power. Due to input current, only 750 W of output power can be supplied when operated with 115 V mains power.

**SYSKON P3000/P4500:** The device must be connected to 400 V 3-phase mains power in order to achieve full nominal power.

Integrated monitoring circuits detect mains power and limit output power in the event of overloading.

The instrument is connected to a mains outlet with earthing contact via the mains inlet connector [18] at the rear panel with the help the included power cable (only included with SYSKON P500/P800/P1500).

### 2.3.5 Connecting Power Consumers

The output leads are connected to the output terminal blocks [14] at the rear panel by means of ring-type cable lugs with the included screws **(SYSKON P500/P800/P1500:** M6 x 10,
**SYSKON P3000/P4500:** M8 x 12 and M6 x 10). In addition to this, 4 mm holes are also provided which are intended for the connection of any utilized measurement cables.

**Connection:**

- Remove the safety cap.
- Connect the output leads to the terminal blocks with the provided screws and washers.
- An adequate wire cross-section and correct polarity must be assured. It’s advisable to twist the output leads and to identify polarity at both ends.
- Avoid exerting excessive force at the terminals.
- Align the leads to the openings in the safety cap.
- Snap the safety cap back into place.

In order to be able to take advantage of highly constant output voltage at the consumer even if long leads are used, sensing leads can be used to compensate for voltage drops within the output leads (see chap. 7).
The terminals for the sensing leads are located in the analog interface.

### 2.3.6 Connection to Computer Interfaces

Three interfaces are available on the instrument for computer-controlled operation.

The device is furnished with a USB port and an RS 232 interface as standard equipment.

A GPIB interface can be ordered as an optional module and installed as described. Installation at a later point in time is also possible.

The instrument cannot be remote controlled via more than one interface at a time. It’s advisable to connect the desired interface only.

However, in order to avoid communications problems with the interfaces, only one interface should be connected to the computer. Problems may otherwise occur.

In order to assure that existing bus activity is not interfered with, all affected devices should be switched off while establishing the bus connection.

**All of the interfaces have a common reference point (GND) which is connected to PE, and are isolated from the output in accordance with the specified electrical safety regulations.**

a) **USB Port**
The type B USB plug is at the at the bottom right-hand side of the front panel. Appropriate USB drivers must be installed, These can be downloaded from the Internet (see chap. 2.3.7).

b) **RS 232C Interface**
The socket connector for the RS 232 interface is on the instrument's rear panel. A 9-pin Sub-D socket connector is used to this end.

**RS 232C Interface:** 9-pin Sub-D socket connector
DIN 41652

Connector Pin Assignments
Pin 2: TXD (transmit data)
Pin 3: RXD (receive data)
Pin 5: GND (ground)

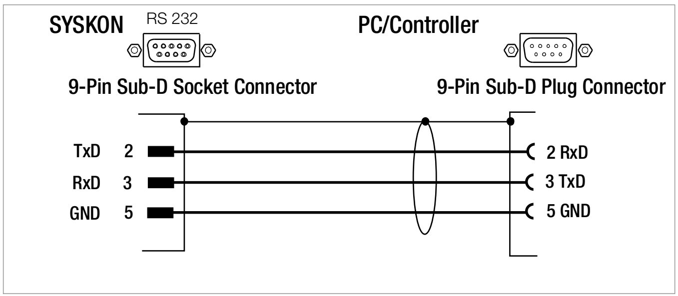



*Figure 1Connector Cable for Serial Interface*

c) **GPIB Bus or IEC Bus Interface (optional)**
This interface is optional and can be installed to the slot provided for this purpose on the rear panel.

**IEEE 488/IEC 625 Interface Connection**
24-pin IEEE 488 socket connector

**IEEE 488/IEC 625 Interface Functions**

| | |
|---|---|
| SH1 | – SOURCE HANDSHAKE |
| AH1 | – ACCEPTOR HANDSHAKE |
| T6 | – TALKER |
| L4 | – LISTENER |
| TE0 | No extended talker function |
| LE0 | No extended listener function |
| SR1 | – SERVICE REQUEST |
| RL1 | – REMOTE / LOCAL |
| DC1 | – DEVICE CLEAR |
| PP1 | – PARALLEL POLL |
| DT1 | – DEVICE TRIGGER |
| C0 | – No controller function |
| E1 / 2 | – Open collector driver |
| Codes/formats | Per IEEE 488.2 |

### 2.3.7 Driver Update (USB device driver)

We recommend updating the drivers under the following circumstances:

- Additional purchases
  (connection of new SYSKON series devices to a PC)
- Retrofitting of interface cards
- Firmware update
- Software update

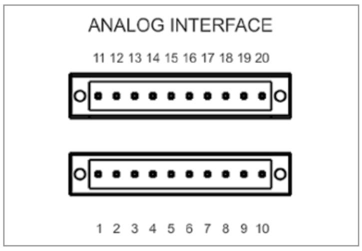
**GMC-I Driver Control** software for installing the USB device driver can be downloaded from our website:

www.gossenmetrawatt.com

The ZIP file must be decompressed in a directory for the purpose of updating. The setup file then appears in the respective directory. Installation is started by double clicking the setup file. A wizard guides you through the installation procedure.

### 2.3.8 Connecting the Analog Interface

The plug connection for the analog interface is located on the rear panel.
Two 10-pin plug-in screw terminal connections are used to this end. The necessary connections for the selected analog control function can be made here.
In order to keep cross-interference with the analog signals to a minimum, it's advisable to use shielded connector cables. The individual signals are described under "Analog Interface".




## 2.4 Switching the Device On

After the described preparations have been completed, the device can be switched on. The mains switch is located at the bottom left-hand side of the front panel.

**Start-Up Routine**

After switching the device on, the "POWER" indicator lamp lights up
[4] and the fan runs. The microprocessor included in
the device then starts a power-up test. The following
operations are performed during the test routine (duration approximately 6 seconds):

- Reset all functional units (except battery-backed configuration memory)
- LED and display segment test
- Hardware/firmware version display (see chap. 2.4.1)
- Mains voltage range detection (see chap. 2.4.2)
- Initialization of the 2 (possibly 3) computer interfaces. If the device has been equipped with the optional "IEEE 488 interface", the selected IEC bus device address then appears briefly at the display (example: "Addr 12").
  Refer to section 6, Main Menu Level, SETUP DISPLAY & INTERFACE, with regard to changing the device address.
- Date display (internal clock)
- Time display (internal clock)
- Recall last settings if required
- Switch to (default after "*RST")
  measured value display for voltage (Uout) and current (Iout).

After initial power-up, the device is set to its basic default configuration (see the table entitled "Adjustable Functions and Parameters" in chap. 10.1).
Upon shipment from the factory, the device is configured such that the setpoints for output voltage and current are set to zero and the power output is set to off.
For further use, status after power on depends upon the selected device configuration.
This configuration is selected either manually with the help of the corresponding menu item, or by means of the POWER_ON command.

**Attention !**

Avoid switching the device on and off in a rapid, repeated fashion. This temporarily impairs the effectiveness of the inrush current limiting function, and may result in a blown fuse.

### 2.4.1 Firmware Versions Table

| Firmware Version | Memory Locations |
|---|---|
| Version 003 | 12 SETUP memory locations<br>1536 SEQUENCE memory locations |
| Version 004 | 15 SETUP memory locations<br>1700 SEQUENCE memory locations |

### 2.4.2 Response After Power On with Changing Mains Voltage Ranges (230 V ↔ 115 V)

**Up to and including firmware version 004**

After "Power On", distinction is made between two available power ranges based on detected mains voltage.

In the event of "low" mains voltage, output power Pnom is cut in half (see chap. 4.1).

In turn, the "PSET < Pnom" setting (or "PSET < Pnom/2" in the case of power derating) is the setting criterion for the "Power Control" function. After an automatic change of Pnom, the PSET value for power control may need to be corrected!

**Power ON & "Power_ON RST / SBY / RCL /..." Setting**

- "RST" Pnom is always reset in accordance with detected mains voltage.
- "SBY", "RCL" Low mains voltage always results in a reduced Pnom value. If the device is then switched on with "high" mains voltage, the low Pnom value remains active until either:
  – A "RESET" is executed (!)
  or
  – "Mains" is switched on again while the "POWER_ON RST" parameter is active

Switching back and forth between mains voltage ranges triggers system messages (see Err AC-L and Err AC-H in chap. 11).

**As of firmware version 005**

After "Power On", distinction is made between two available power ranges based on detected mains voltage.

In the event of "low" mains voltage, output power is limited to about 55% nominal power.
If the device is switched on with the "POWER_ON RST" setting and "low" mains voltage, the setting limit for the PSET parameter is reduced to 50% nominal power.

In turn, the "PSET < Pnom" setting (or "PSET < Pnom/2" in the case of power derating) is the setting criterion for the "Power Control" function.

**Power ON & "Power_ON RST / SBY / RCL /..." Setting**

- "RST" Pnom is always reset in accordance with detected mains voltage.
- "SBY", "RCL" Low mains voltage always results in reduced maximum output power. However, the setting limits for the PSET parameter remain unchanged until either:
  – Memory recall for a corresponding device setting is executed
  or
  – "Mains" is switched on again while the "POWER_ON RST" parameter is active

Switching back and forth between mains voltage ranges triggers system messages (see Err AC-L and Err AC-H in chap. 11).

# 3 Technical Description

## Description

SYSKON KONSTANTERs are manual and remote controllable DC power supplies for laboratory and system use. Thanks to modern switching controller technology, the devices are compact and lightweight despite their high output power.

Active power factor control assures nearly sinusoidal mains input current.

The floating output features “safety separation” from the mains input as well as from the computer interfaces, and is classified as a safety extra-low voltage circuit (SELV) in accordance with VDE/ IEC. Wide ranging nominal output power values are available from output voltage and output current.

The power output is voltage and current controlled with limiting for maximum withdrawable power.

Transition to the control modes is automatic in accordance with the selected setpoints and load circumstances.

The control loops are designed for short response times.

An automatically activated, dynamic sink (can be deactivated) provides for quick discharging of the output capacitors.

Numerous protective functions and monitoring devices allow for ideal adaptation to the actual conditions of use.

## Features

The devices are generally equipped with a control panel and display, as well as an analog interface.

One USB port and one RS 232 interface are provided as standard equipment for integration into computer controlled systems. Drivers for the USB interface are available for download from our website (Driver Control).

An IEEE 488 interface can be additionally installed to the device from the outside or retrofitted as an option.

Manual adjustment of voltage and current is accomplished by means of two rotary encoders with selectable resolution, or with the numeric keypad. Numerous additional functions can be accessed via keys.

Two 5-place digital LED displays read out measured values and settings. LEDs indicate the current operating mode, selected display parameters and the status of device and interface functions.

The analog interface makes it possible to adjust output voltage and current with the help of external control voltages. Monitor outputs read out an analog representation of the voltage and current output quantities for further processing or additional displays.

These control inputs and monitor outputs can also be used to link several devices for master operation with parallel or series connection.

Two floating trigger inputs are available for controlling certain device functions. For example, they can be used to switch the output on and off or to control sequences.

Furthermore, three signal outputs are included at the analog interface, two of which are floating. These can be activated depending upon various functions, and can thus be used to control external devices or sequences.

## Applications Range

Konstanters are suitable for use wherever electronic modules need to be supplied with controlled direct voltage or controlled current, especially in the fields of R&D, testing, production, test systems and training.

Thanks to their characteristic U-I-P curve, the devices have a broad working range, making it possible to cover a large range of applications with a single device.

Due to their short response times, SYSKON KONSTANTERs can be used for replication and simulation of onboard electrical systems, for example in automotive applications. Test signals specified in the corresponding standards can be generated. The fact that these voltage-current-time profiles can be saved to memory at the Konstanter for running independent sequences is highly advantageous. When used in test systems, it’s thus possible to significantly reduce workload for the control computer. Further functions for test applications of this sort include the Min-Max function for acquiring extreme values and the tolerance band function which generates a signal when measured values do not lie within the specified tolerance limits.

The Konstanter thus serves as an autonomous test system for many applications.

## Adjustable Functions (selection)

– Voltage and current setpoint values
– Voltage and current limit values (soft-limits)
– Activate/deactivate the output
– Overvoltage protection trigger value (OVP)
– Overcurrent protection trigger value (OCP)
– Delay time for reaction to overvoltage
– Selection of the desired reaction when OVP and OCP are triggered
– Delay time for reaction to overcurrent
– Performance after power on
– Reset device settings
– Save device settings
– Recall device settings, individually or sequentially
– Function selection for trigger input
– Configurable status and events management with enabling windows (via computer interface)
– Activate/deactivate digital displays

## Retrievable Information (selection)

– Presently measured voltage and current values
– Minimum and maximum measured voltage and current values
– Momentary output power
– Momentary device settings
– Momentary device status (e.g. control mode, overtemperature)
– Occurred events (e.g. power failure, overtemperature, overvoltage, overload)
– Device ID (via computer interface)

## Protection and Additional Functions

– Sensor terminals protected against polarity reversal and automatic switching to auto-sensing
– Overtemperature protection
– Output protected against reverse polarity
– Front panel control disabling
– Backup battery for device settings memory
– Recognition of mains or phase failure
– Inrush current limiting

### Performance After Power On

In the event of mains failure, it's important to specify which operating state the device will assume when power is restored. This may be extremely important if the device is used in long-term testing applications.

One of the following states can be selected:

- Reset = default setting (0 V, 0 A, output deactivated)
- Standby= last used configuration but with deactivated output
- Recall = last used configuration – same as when the instrument was last switched off, with active output if it was active prior to mains failure
- Recall a device configuration from setup memory

### Setting Output Voltage and Output Current

Output voltage and output current can be adjusted using either the rotary encoders or the numeric keypad. The rotary encoders are used exclusively for adjusting voltage and current. The digit to be changed is selected with the scroll keys Additional functions and parameters can be accessed and adjusted with the keys.

### Switching the Input On and Off

The power output can be switched on and off by pressing the appropriate key, with a computer command or by applying a signal to the trigger input. When switched off, the output is highly resistive and is not electrically isolated from the power consumer. The LED on the key indicates the status.

### Protection and Additional Functions

A multitude of protection and monitoring functions have been integrated, for example:

- Limiting of the setting ranges for voltage and current
- Overvoltage protection (OVP) with adjustable response delay and reaction
- Overcurrent protection (OCP) with adjustable response delay and reaction
- Protection in the event of reversed polarity at the sensing leads
- Automatic switching to auto-sensing
- Overtemperature protection
- Output protected against reverse polarity
- Front panel control disabling
- Backup battery for device settings memory
- Inrush current limiting
- Power monitoring

### Power Monitoring

In the event of voltage dips or short-term interruptions, the power output is shut down and disabled in order to protect the device. The device must be restarted via "Power On".

### Dynamic Sink

A dynamic sink is activated by the control loops as required for rapid discharging of the output capacitors.

This allows for short response times when switching to smaller setpoint values. Depending upon the application, the sink function can also be deactivated.

### Auto-Sensing

The device can be switched to sensing mode operation (remote sensing) in order to compensate for voltage drops at the output leads. Sensing lead terminals are available to this end at the analog interface. If the (–) negative sensing terminal is connected to the negative load point, the device is automatically switched to sensing mode operation. Maximum compensatable voltage drop is 1 V per output lead.

### Front Panel Control Disabling

The controls can be disabled to prevent unauthorized operation by pressing the appropriate key, with a computer command or by applying a signal to the trigger input.

### Analog Control Inputs

Voltage and current can also be adjusted by via the control inputs at the analog interface.

A 5 V signal corresponds to 100% of the respective nominal value.

These inputs can be switched on and off via key operation or computer command.

The controlled output quantity is the sum of the digital setpoint value and the specified value at the control input.

This function makes it possible to superimpose the output quantities with these control signals.

### Monitor Outputs

The actual values for output voltage and current can be acquired as a standardized variable at the monitor outputs (10 V corresponds to 100% nominal value).

### Trigger Inputs

Two floating trigger inputs are available for controlling device functions.

The following options are available for trigger input assignments:

- Output = Switch power output off/on
- Local lock = Disable controls
- SQS = (Sequence step) step-by-step control of a stored sequence
- Sequence = Start / stop the sequence function
- Analog input = Activate / deactivate the analog control inputs

### Signal Outputs

Programmable Control Outputs

The analog interface is equipped with three digital control outputs for status messages to external monitoring devices, for switching external components on and off or for coupling purposes.

The status of these outputs can be defined either directly, or depending upon the following device statuses

- Output on or off
- Voltage or current regulation
- Sequence function running or finished
- SSET signal status for the sequence function
- Limit value message for the measuring function (tolerance band)

### Min-Max Measured Value Memory

The MIN/MAX function automatically detects and saves measured minimum and maximum voltage and current values.

### Tolerance Band (in combination with Min/Max function)

Measured output values can be continuously compared with stored upper and lower tolerance band values. Evaluation is possible via the programmable control outputs.

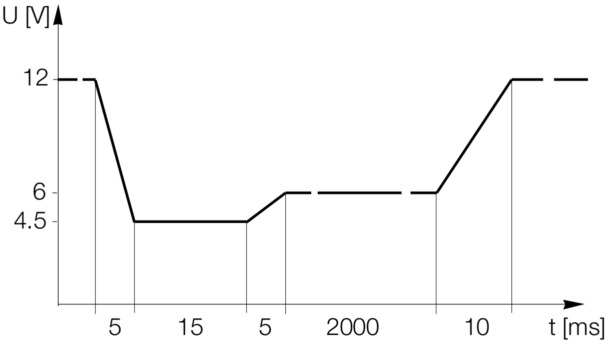
### Memory

The memory function makes it possible to save and recall device configurations using a battery-backed memory module.
The memory module is equipped with two storage areas:

- Setup memory: 12/15 memory locations for complete settings
- Sequence memory: 1536/1700 memory locations for the following sequence parameters: voltage setpoint USET, current setpoint ISET,
  dwell time TSET and function request FSET
  with the ability to invoke subsequences

### Sample Application

Generation of a Characteristic Voltage Curve in an Automotive Electrical System when Starting the Engine




Note:

Decay times may be affected by the input impedance of the device under test.

### Balancing Function (adjust)

Offset and range limit values for setting and measured values for voltage and current output quantities are balanced digitally in the device. The user can execute balancing as required with this function.

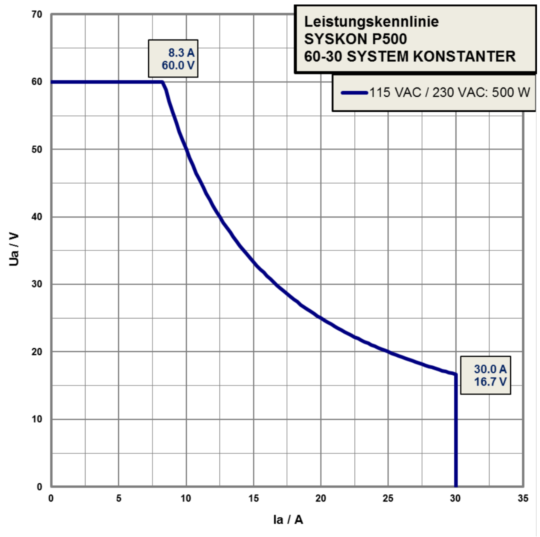
### DAkkS Calibration Certificate

All SYSKON Konstanters are shipped with a DAkkS calibration certificate issued by our DAkkS test laboratory.

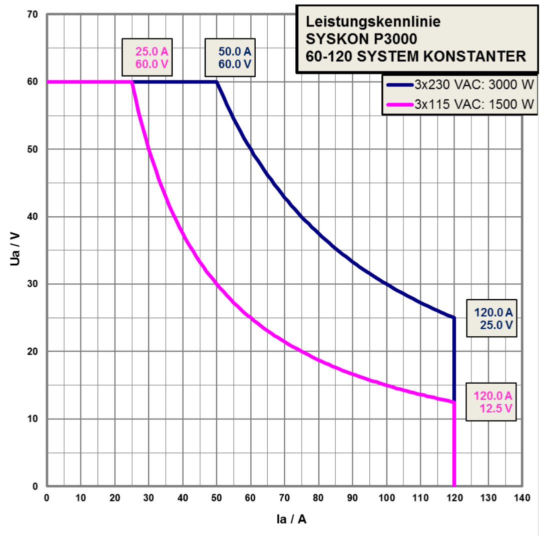
# 4 Technical Data

## 4.1 General Data

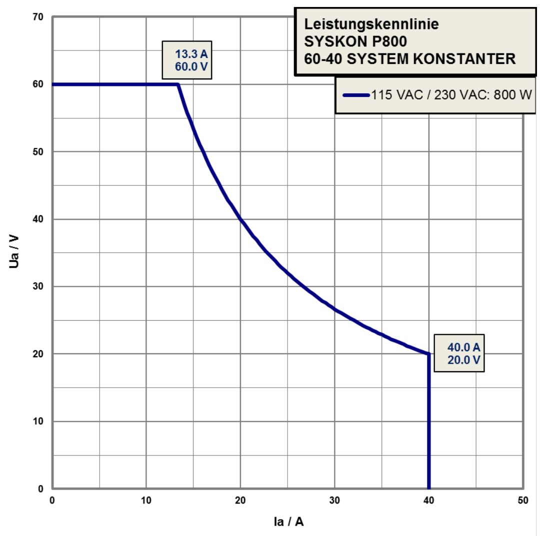
### Output Operating Ranges, Characteristic U-I-P Curve, SYSKON P500



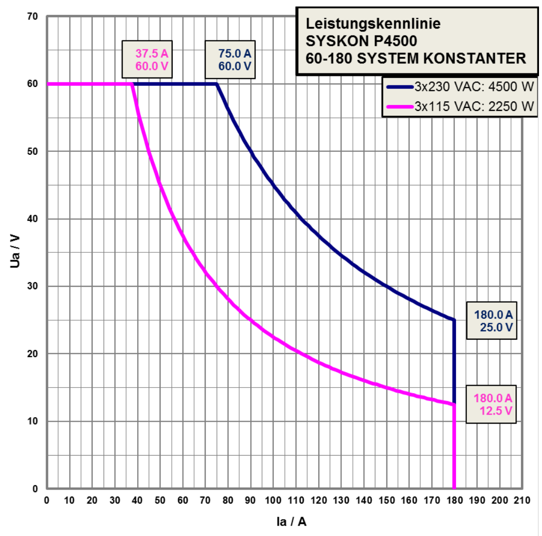

### Output Operating Ranges, Characteristic U-I-P Curve, SYSKON P3000




### Output Operating Ranges, Characteristic U-I-P Curve, SYSKON P800

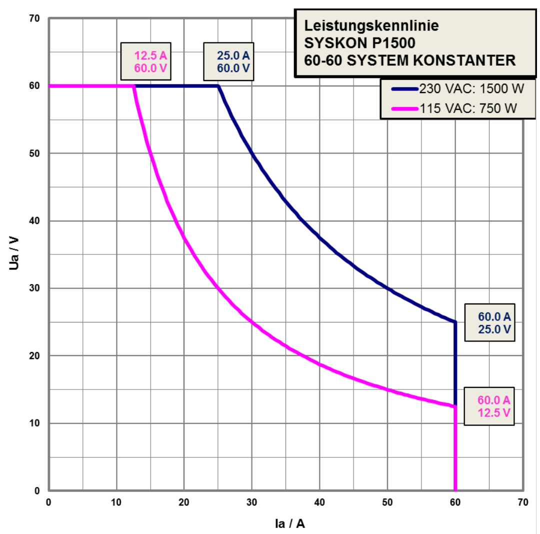



### Output Operating Ranges, Characteristic U-I-P Curve, SYSKON P4500*




* The S-002 variant of the SYSKON P4500 functions without any derating.

### Output Operating Ranges, Characteristic U-I-P Curve, SYSKON P1500




### Output

| | |
|---|---|
| Regulator type | Primary switched-mode regulator |
| Operating Modes | Adjustable constant voltage / constant current source with automatic sharp transition |
| Output insulation | Floating output with “safe electricalseparation” from the mains input and computer interfaces |
| Permissible potential output–ground | Max. 240 V DC |

Capacitance, output–ground (housing)

| | |
|---|---|
| SYSKON P500 | Typically 1000 nF |
| SYSKON P800 | Typically 1000 nF |
| SYSKON P1500 | Typically 1000 nF |
| SYSKON P3000 | Typically 1000 nF |
| SYSKON P4500 | Typically 1000 nF |

### Analog Interface

| | |
|---|---|
| Functions | – Auto-sensing mode<br>– 2 programmable trigger inputs<br>– 3 programmable signal outputs<br>– Voltage control input (0 … 5 V)<br>– Current control input (0 … 5 V)<br>– Voltage monitor output (0 … 10 V)<br>– Current monitor output (0 … 10 V)<br>– Master parallel operation<br>– Master series operation<br>– Auxiliary power output: 15 V / 60 mA |

### Computer Interfaces

- IEC-625 / IEEE 488 interface (optional)

- RS 232 interface

| | |
|---|---|
| Transmission mode | Asynchronous |
| Transmission speed | 1200 to 115,200 baud, adjustable |

- USB port

USB port: 4-pin, type B,
USB 1.1 compatible with USB 2.0
Connector pin assignments 1:VCC, 2:D-, 3:D+, 4:GND

| | |
|---|---|
| Transmission speed | 9600 to 115,200 baud, adjustable |

### Power Supply

| | |
|---|---|
| Line voltage | 115/230 V ~ +10 / –15%; 47 to 63 Hz |
| Inrush current | Max. 50 A |
| Mains fuse | SYSKON P500/P800/P1500:<br>1 x M15 A/250 V (6.3 x 32 mm), UL<br>SYSKON P3000/4500: 3 x M15 A/250 V |

### Electrical Safety

| | |
|---|---|
| Protection class | I |
| Measuring category | II for mains input<br>I for output and interfaces |
| Pollution degree | 2 |
| Earth leakage current | < 2,5 $mA_{RMS}$ |

| | |
|---|---|
| Electrical isolation | Test voltage |
| Output – mains | 2.2 kV ~ |
| Output – bus/ground | 1.4 kV ~ |
| Mains – bus/ground | 2.2 kV – |
| Bus – ground | No electrical isolation |

### Applicable Standards

IEC 61010-1:2010
DIN EN 61010-1:2010
VDE 0411-1:2011
EN 61326

### 4.1.1 Electromagnetic Compatibility

#### SYSKON P500/P800/P1500

| | |
|---|---|
| Product standard | EN 61326-1: October 2006 |
| Interference emission | EN 55022: Class B |
| Interference immunity | EN 61000-4-2: feature A<br>EN 61000-4-3: feature B<br>EN 61000-4-4: feature A<br>EN 61000-4-5: feature A<br>EN 61000-4-6: feature A<br>EN 61000-4-8: feature A<br>EN 61000-4-11: feature A |

#### SYSKON P3000/4500

| | |
|---|---|
| Product standard | EN 61326-1: October 2006 |
| Interference emission | EN 55022: Class A * |
| Interference immunity | EN 61000-4-2: feature B<br>EN 61000-4-3: feature A<br>EN 61000-4-4: feature B<br>EN 61000-4-5: feature B<br>EN 61000-4-6: feature A<br>EN 61000-4-8: feature A<br>EN 61000-4-11: feature B |

* **Note:**
Approved for use in industrial environments. This device may cause radio interference in residential areas.

### 4.1.2 Ambient Conditions

| | | |
|---|---|---|
| Temperature range | Operation: | 0 to 40 °C |
| | Storage: | –25 to +75 °C |
| Relative humidity | Operation: | ≤ 75% relative humidity, no condensation |
| | Storage: | ≤ 65% relative humidity |
| Cooling | With integrated fan (temperature controlled) | |
| | Air intake: | side panel |
| | Air outlet: | rear panel |
| Operating noise | Noise pressure level at a distance of 30 cm with fan set to low / high | |
| | Front | 17 / 28 dBA |
| | Rear | 22 / 32 dBA |
| | Left | 17 / 28 dBA |
| | Right | 20 / 31 dBA |

## 4.2 Mechanical data

Protection IP 00 for device and interface connections
IP 20 for housing

Table Excerpt Regarding Significance of IP Codes

| IP XY (1st digit X) | Protection Against Foreign Object Ingress | IP XY (2nd digit Y) | Protection Against Water Ingress |
|---|---|---|---|
| 0 | Not protected | 0 | Not protected |
| 1 | ≥ 50.0 mm dia. | 1 | Vertically falling droplets |
| 2 | ≥ 12.5 mm dia. | 2 | Dripping (at 15° angle) |

**Design** **Benchtop device, suitable for installation to 19" cabinets**

| Article no. | Designation | Dimensions (W x H x D) | Weight |
|---|---|---|---|
| K346A | SYSKON P500-060-030 | 19" x 2 standard height units<br>447 x 102 (88) x 541 (501) mm | 10 kg |
| K347A | SYSKON P800-060-040 | 19" x 2 standard height units<br>447 x 102 (88) x 541 (501) mm | 10 kg |
| K353A | SYSKON P1500-060-060 | 19" x 2 standard height units<br>447 x 102 (88) x 541 (501) mm | 10 kg |
| K363A | SYSKON P3000-060-120 | 19" x 4 standard height units<br>447 x 191 (177) x 541 (501) mm | 16 kg |
| K364A | SYSKON P4500-060-180 | 19" x 4 standard height units<br>447 x 191 (177) x 541 (501) mm | 20 kg |
| K384A | IEEE 488 interface (optional) | | Approx. 0.14 kg |

### 4.2.1 Terminals (rear panel)

Mains Input SYSKON P500/P800/P1500:
10 A IEC inlet plug
with earthing contact (L + N + PE)

SYSKON P3000/4500:
Connector terminals (min. 16 A)
(L1 + L2 + L3 + N + PE)

Output SYSKON P500/P800/P1500:
Threaded terminal blocks for M6 screws and 4 mm diameter holes

SYSKON P3000/4500:
Threaded terminal blocks for M8 sand M6 screws and 4 mm diameter holes

Analog interface / sensing leads Double row plug connector
with two 10-pole screw terminals

## 4.3 Electrical Data

| Article Number | | K346A | K347A | K353A |
|---|---|---|---|---|
| Type | | SYSKON P500-060-030 | SYSKON P800-060-040 | SYSKON P1500-060-060 |
| **Nominal Output Data** | Voltage setting range | 0 … 60 V | 0 … 60 V | 0 … 60 V |
| | Current setting range | 0 … 30 A | 0 … 40 A | 0 … 60 A |
| | Power | Max. 500 W | Max. 800 W | Max. 1500 W |
| **Output characteristics** (ppm and percentage values make reference to the respective setting or measured value) | | | | |
| Setting Resolution | Voltage | 1 mV | 1 mV | 1 mV |
| | Current | 1 mA | 1 mA | 1 mA |
| Setting accuracy (at 23 ± 5 °C) Auto-sensing mode | Voltage | 0.05% + 30 mV | 0.05% + 30 mV | 0.05% + 30 mV |
| Without auto-sensing | | 0.05% + 48 mV | 0.05% + 48 mV | 0.05% + 48 mV |
| | Current | 0.05% + 90 mA | 0.05% + 90 mA | 0.05% + 90 mA |
| Temperature coefficient | Voltage | 100 ppm | 100 ppm | 100 ppm |
| of setting Δ / K | Current | 100 ppm | 100 ppm | 100 ppm |
| Setting accuracy via analog interface (at 23 ±5 °C), | Voltage | 0.6% + 120 mV | 0.6% + 120 mV | 0.6% + 120 mV |
| $U_{setnom}/U_{setanalog} = 12$; $I_{setnom}/I_{setanalog} = 12/24/36$ | Current | 0.6% + 120 mA | 0.6% + 120 mA | 1.2% + 120 mA |
| Static system deviation Auto-sensing mode | Voltage | 30 mV (< 500 µV/A) | 30 mV (< 500 µV/A) | 30 mV (< 500 µV/A) |
| at 100% load fluctuation Without auto-sensing | | 48 mV (< 800 µV/A;) | 48 mV (< 800 µV/A;) | 48 mV (< 800 µV/A;) |
| | Current | 30 mA (< 500 µA/V) | 30 mA (< 500 µA/V) | 30 mA (< 500 µA/V) |
| Static system deviation | Voltage | 5 mV | 5 mV | 5 mV |
| with 10% line voltage fluctuation | Current | 5 mA | 5 mA | 5 mA |
| Residual ripple Voltage | Ripple: 10 Hz to 20 kHz | 40 $mV_{ss}$ | 40 $mV_{ss}$ | 40 $mV_{ss}$ |
| | Ripple: 10 Hz to 1 MHz | 50 $mV_{ss}$ | 50 $mV_{ss}$ | 50 $mV_{ss}$ |
| | Ripple + noise 10 Hz to 10 MHz | 60 $mV_{ss}$ / 6 $mV_{RMS}$ | 60 $mV_{ss}$ / 6 $mV_{RMS}$ | 60 $mV_{ss}$ / 6 $mV_{RMS}$ |
| Current | Ripple + noise 10 Hz to 10 MHz | 50 $mA_{eff}$ | 50 $mA_{eff}$ | 50 $mA_{eff}$ |
| | Tolerance | 120 mV | 120 mV | 120 mV |
| Output voltage transient recovery time with | ΔI = 10% | 100 µs | 100 µs | 100 µs |
| sudden load variation within a range of 20 to 100% $I_{nom}$ | ΔI = + 80% + approx. 800 A/ms | 600 µs | 500 µs | 400 µs |
| and 20 to 100% $U_{nom}$ | ΔI = – 80% + approx. 1200 A/ms | 950 µs | 650 µs | 500 µs |
| Output voltage over and undershooting with sudden | | | | |
| load variation within a range of 20 to 100% $I_{nom}$ | ΔI = 10% | 150 mV | 150 mV | 150 mV |
| and 20 to 100% $U_{nom}$ | ΔI = 80% | 500 mV | 550 mV | 700 mV |
| Setting time for output voltage [1] | Tolerance | 120 mV | 120 mV | 120 mV |
| for Uset jump = 0 V → 60 V | No-load / nominal load [2] | 2 ms / 2 ms | 2 ms / 2 ms | 2 ms / 2 ms |
| for Uset jump = 60 V → 1 V | No-load / nominal load [2] | 70 ms / 20 ms | 70 ms / 15 ms | 70 ms / 11 ms |
| (500 W/800 W/1500 W) | | | | |
| for Uset jump = 0 V → 16.7 V / 20 V / 25 V | No-load / nominal load [2] | 1.4 ms / 1.4 ms | 1.4 ms / 1.4 ms | 1.4 ms / 1.4 ms |
| for Uset jump = 16.7 V / 20 V / 25 V → 1 V | No-load / nominal load [2] | 16 ms / 5 ms | 16 ms / 3 ms | 16 ms / 3 ms |
| Output capacitor | Nominal value | 2020 µF | 2020 µF | 2020 µF |
| Sink (continuous power) | Power | 40 to 65 W | 40 to 65 W | 40 to 65 W |
| **Measuring Function** | | | | |
| Measuring Range | Voltage | –16.384 … + 98.300 V | – 16.384 … + 98.300 | –16.384 … + 98.300 V |
| | Current | – 32.766 … + 98.300 A | – 32.766 … + 98.300 A | – 32.766 … + 98.300 A |
| | Power | U x I | U x I | U x I |
| Measuring Resolution | Voltage | 2 mV | 2 mV | 2 mV |
| | Current | 2 mA | 2 mA | 2 mA |
| | Power | 100 mW | 100 mW | 100 mW |
| Measuring accuracy (at 23 ± 5 °C) | Voltage | 0.05% + 30 mV | 0.05% + 30 mV | 0.05% + 30 mV |
| | Current | 0.4% + 90 mA | 0.4% + 90 mA | 0.4% + 90 mA |
| | Power | 0.5% + 1 W | 0.5% + 1 W | 0.5% + 1 W |
| Measured value temperature coefficient Δ / K | Voltage | 50 ppm + 0.4 mV | 50 ppm + 0.4 mV | 50 ppm + 0.4 mV |
| | Current | 100 ppm 1 mA | 100 ppm 1 mA | 100 ppm 1 mA |
| Measuring accuracy (at 23 ± 5 °C) at the analog interface | Voltage | 0.4% + 120 mV | 0.4% + 120 mV | 0.4% + 120 mV |
| Uactualnom / Uactualanalog = 6; Iactualnom / Iactualanalog = 6/12/18 | Current | 0.5% + 180 mA | 0.5% + 180 mA | 1.2% + 180 mA |
| **Protection and Additional Functions** | | | | |
| Output overvoltage protection Trigger value | Setting Range | 3 … 80 V | 3 … 80 V | 3 … 80 V |
| | Setting Resolution | 20 mV | 20 mV | 20 mV |
| | Setting Accuracy | ±150 mV –10 mΩ x $I_a$ | ±150 mV –20 mΩ x $I_a$ | ±150 mV –10 mΩ x $I_a$ |
| Response time | | 200 µs | 200 µs | 200 µs |
| Output overcurrent protection Trigger value | Setting Range | 1.5 … 40 A | 2 … 53 A | 3 … 80 A |
| | Setting Resolution | 20 mA | 20 mA | 20 mA |
| | Setting Accuracy | –(1% + 350 mA) – 20 mA/V x $U_a$ | –(1% + 350 mA) – 20 mA/V x $U_a$ | –(1% + 350 mA) – 20 mA/V x $U_a$ |
| Response time | | 200 µs | 200 µs | 200 µs |
| Reverse polarity protection load capacity | Cont. | 30 A | 40 A | 60 A |
| Reverse voltage withstand capacity | Cont. | 70 V – | 70 V – | 70 V – |
| Auto-sensing mode Compensatable voltage drop | per output lead | 1 V | 1 V | 1 V |
| **General** | | | | |
| Power supply with 230 V~ nominal line voltage | Line voltage | **230 V~** + 10 / – 15%, | **230 V~** + 10 / – 15%, | **230 V~** + 10 / – 15%, |
| Power consumption | | 47 … 63 Hz | 47 … 63 Hz | 47 … 63 Hz |
| | At 100% nominal load | 700 VA; 650 W | 1050 VA; 1000 W | 1925 VA; 1865 W |
| | At no load | 96 VA; 37 W | 96 VA; 37 W | 96 VA; 37 W |
| Power supply with 115 V~ nominal line voltage | Line voltage | **115 V~** + 10 / – 15%, | **115 V~** + 10 / – 15%, | **115 V~** + 10 / – 15%, |
| Power consumption | | 47 … 63 Hz | 47 … 63 Hz | 47 … 63 Hz |
| | At 50% nominal load | 800 VA; 750 W | 1175 VA; 1150 W | 1125 VA; 1100 W |
| | At no load | 55 VA; 36 W | 55 VA; 36 W | 55 VA; 36 W |
| Max. power loss | At nominal load: 500 W/800 W/1500 W (230 V~) | 150 W | 200 W | 365 W |
| | At nominal load: 500 W/800 W/750 W (115 V~) | 250 W | 350 W | 350 W |
| Degree of efficiency | At nominal load: 500 W/800 W/1500 W (230 V~) | 77% | 80% | 80% |
| | At nominal load: 500 W/800 W/750 W (115 V~) | 66% | 70% | 68% |
| Switching frequency, PFC / DC/DC | Typical | 47 kHz / 230 kHz | 47 kHz / 230 kHz | 47 kHz / 230 kHz |
| Inrush current | Max. | 50 $A_s$ | 50 $A_s$ | 50 $A_s$ |
| Mains fuse (6.3 x 32 mm, UL) | | 1 x M 15 A / 250 V | 1 x M 15 A / 250 V | 1 x M 15 A / 250 V |
| MTBF (mean time between failures) | at 40 °C | > 50,000 hours | > 50,000 hours | > 50,000 hours |

[1] At maximum current setting not including processing time for the previous voltage setting command

[2] Nominal load: Rload = $Uset^2$ / Pnom

| **Article Number** | | **K363A** | **K364A** |
|---|---|---|---|
| **Type** | | **SYSKON P3000-060-120** | **SYSKON P4500-060-180** |
| **Nominal Output Data** | Voltage setting range | 0 … 60 V | 0 … 60 V |
| | Current setting range | 0 … 120 A | 0 … 180 A |
| | Power | Max. 3000 W | Max. 4500 W |
| **Output characteristics (ppm and percentage values make reference to the respective setting or measured value)** | | | |
| Setting Resolution | Voltage | 1 mV | 1 mV |
| | Current | 2 mA | 3.125 mA |
| Setting accuracy (at 23 ± 5 °C) Auto-sensing mode | Voltage | 0.07% + 48 mV | 0.1% + 48 mV |
| Without auto-sensing | | 0.07% + 60 mV | 0.1% + 60 mV |
| | Current | 0.1% + 135 mA | 0.15% + 180 mA |
| Temperature coefficient | Voltage | 100 ppm | 100 ppm |
| of setting Δ / K | Current | 100 ppm | 100 ppm |
| Setting accuracy via analog interface (at 23 ±5 °C), | Voltage | 0.6% + 150 mV | 0.6% + 150 mV |
| $U_{setnom}/U_{setanalog}$ = 12; $I_{setnom}/I_{setanalog}$ = 12/24/36 | Current | 1.2% + 180 mA | 1.2% + 240 mA |
| Static system deviation Auto-sensing mode | Voltage | 60 mV (< 500 µV/A) | 90 mV (< 500 µV/A) |
| at 100% load fluctuation Without auto-sensing | | 96 mV (< 800 µV/A) | 144 mV (< 800 µV/A) |
| | Current | 60 mA (< 1000 µA/V) | 90 mA (< 1500 µA/V) |
| Static system deviation | Voltage | 7 mV | 10 mV |
| with 10% line voltage fluctuation | Current | 30 mA | 60 mA |
| Residual ripple Voltage | Ripple: 10 Hz to 20 kHz | 60 $mV_{ss}$ | 80 $mV_{ss}$ |
| | Ripple: 10 Hz to 1 MHz | 75 $mV_{ss}$ | 100 $mV_{ss}$ |
| | Ripple + noise 10 Hz to 10 MHz | 90 $mV_{ss}$ / 10 $mV_{RMS}$ | 120 $mV_{ss}$ / 15 $mV_{RMS}$ |
| Current | Ripple + noise 10 Hz to 10 MHz | 70 $mA_{eff}$ | 100 $mA_{eff}$ |
| | Tolerance | 120 mV | 120 mV |
| Output voltage transient recovery time with sudden | ΔI = 10% | 400 µs | 500 µs |
| load variation within a range of 20 to 100% $I_{nom}$ | ΔI = + 80% + approx. 800 A/ms | 1200 µs | 1600 µs |
| and 20 to 100% $U_{nom}$ | ΔI = – 80% + approx. 1200 A/ms | 1900 µs | 2500 µs |
| Output voltage over and undershooting with sudden | | | |
| load variation within a range of 20 to 100% $I_{nom}$ | ΔI = 10% | 200 mV | 250 mV |
| and 20 to 100% $U_{nom}$ | ΔI = 80% | 1200 mV | 1300 mV |
| Setting time for output voltage [1] | Tolerance | 120 mV | 120 mV |
| for Uset jump = 0 V → 60 V | No-load / nominal load [2] | 4 ms / 15 ms | 7 ms / 19 ms |
| for Uset jump = 60 V → 1 V | No-load / nominal load [2] | 70 ms / 11 ms | 70 ms / 11 ms |
| for Uset jump = 0 V → 25 V | No-load / nominal load [2] | 1.2 ms / 6 ms | 2.4 ms / 11 ms |
| for Uset jump = 25 V → 1 V | No-load / nominal load [2] | 16 ms / 6 ms | 16 ms / 6 ms |
| Output capacitor | Nominal value | 4040 µF | 6060 µF |
| Sink (continuous power) | Power | 80 W – 130 W | 120 W – 195 W |
| **Measuring Function** | | | |
| Measuring Range | Voltage | – 16.384 … + 98.300 | – 16.384 … + 98.300 |
| | Current | – 65.532 … + 196.600 A | – 98.298 … + 294.900 A |
| | Power | U x I | U x I |
| Measuring Resolution | Voltage | 2 mV | 2 mV |
| | Current | 4 mA | 6 mA |
| | Power | 100 mW | 100 mW |
| Measuring accuracy (at 23 ± 5 °C) | Voltage | 0.07% + 48 mV | 0.1% + 48 mV |
| | Current | 0.6% + 120 mA | 0.8% + 180 mA |
| | Power | 0.7% + 2 W | 1% + 3 W |
| Measured value temperature coefficient Δ / K | Voltage | 50 ppm + 0.6 mV | 50 ppm + 0.8 mV |
| | Current | 100 ppm 2 mA | 100 ppm 3 mA |
| Measuring accuracy (at 23 ± 5 °C) at the analog interface | Voltage | 0.6% + 180 mV | 0.8% + 180 mV |
| Uactualnom / Uactualanalog = 6; Iactualnom / Iactualanalog = 6/12/18 | Current | 1.2% + 240 mA | 1.2% + 300 mA |
| **Protection and Additional Functions** | | | |
| Output overvoltage protection Trigger value | Setting Range | 3 … 80 V | 3 … 80 V |
| | Setting Resolution | 20 mV | 20 mV |
| | Setting Accuracy | ±150 mV –20 mΩ x $I_a$ | ±150 mV –20 mΩ x $I_a$ |
| Response time | | 200 µs | 200 µs |
| Output overcurrent protection Trigger value | Setting Range | 6 … 160 A | 9 … 240 A |
| | Setting Resolution | 50 mA | 100 mA |
| | Setting Accuracy | –(1% + 500 mA) – 40 mA/V x $U_a$ | –(1% + 700 mA) – 60 mA/V x $U_a$ |
| Response time | | 200 µs | 200 µs |
| Reverse polarity protection load capacity | Cont. | 120 A | 180 A |
| Reverse voltage withstand capacity | Cont. | 70 V – | 70 V – |
| Auto-sensing mode Compensatable voltage drop | per output lead | 1 V | 1 V |
| **General** | | | |
| Power supply with 230 V~ nominal line voltage | Line voltage | 3 x 230/400 V~ + 10 / – 15% | 3 x 230/400 V~ + 10 / – 15% |
| Power consumption | | 47 … 63 Hz | 47 … 63 Hz |
| | At 100% nominal load | 3810 VA; 3710 W | 5660 VA; 5500 W |
| | At no load | 100 VA; 45 W | 110 VA; 55 W |
| Power supply with 115 V~ nominal line voltage | Line voltage | 3 x 115/200 V~ + 10 / – 15% | 3 x 115/200 V~ + 10 / – 15% |
| Power consumption | | 47 … 63 Hz | 47 … 63 Hz |
| | At 50% nominal load | 2215 VA; 2180 W | 3305 VA; 3255 W |
| | At no load | 73 VA; 48 W | 92 VA; 60 W |
| Max. power loss | At nominal load: 3000 W/4500 W (230 V~) | 710 W | 1100 W |
| | At nominal load: 1500 W/2250 W (115 V~) | 680 W | 1030 W |
| Degree of efficiency | At nominal load :3000 W/4500 W (230 V~) | 81% | 82% |
| | At nominal load: 1500 W/2250 W (115 V~) | 69% | 69% |
| Switching frequency, PFC / DC/DC | Typical | 47 kHz / 230 kHz | 47 kHz / 230 kHz |
| Inrush current | Max. | 50 $A_s$ | 50 $A_s$ |
| Mains fuse (6.3 x 32 mm, UL) | | 3 x M 15 A / 250 V | 3 x M 15 A / 250 V |
| MTBF (mean time between failures) | at 40 °C | > 40,000 h | > 30,000 h |

[1] At maximum current setting not including processing time for the previous voltage setting command

[2] Nominal load: Rload = $Uset^2$ / Pnom

### 4.3.1 Reference Conditions

| | |
|---|---|
| Ambient temperature | 23 °C ±2 K |
| Relative humidity | 40 to 60% |
| Warm-up time | 30 minutes |

Output characteristics (ppm and percentage values make reference to the respective setting or measured value)

# 5 Controls, Display Elements and Terminals

## 5.1 Front Panel SYSKON P500 / P800 / P1500

### Control Mode Status Display

| | |
|---|---|
| **CV** LED lights up | Constant voltage regulating mode: Uout ≈ Uset |
| LED **Plim / CP*** lights up | **yellow:** Pout > Pnom (OL) **green*:** PSET < Pnom progr. (CP) |
| **CC** LED lights up | Constant current regulating mode: Iout ≈ Iset |

### Protective Functions and Status Displays

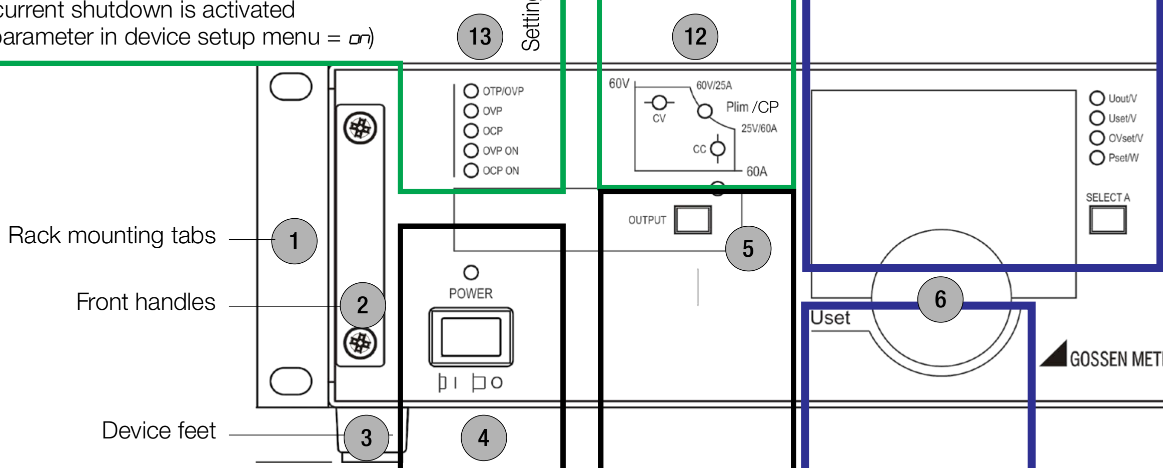
| | |
|---|---|
| **OTP/OVP** LED lights up | Overtemperature protection triggered or output voltage ≥ 80 V exceeded, ➩ OUTPUT = off |
| **OVP** LED lights up | Overvoltage detection triggered, oUSEt and oUdLY parameter values exceeded (prerequisite: oUP parameter = on) ➩ OUTPUT = off |
| **OCP** LED lights up | Overcurrent detection triggered, oCSEt and oCdLY parameters exceeded (prerequisite: oCP parameter = on) ➩ OUTPUT = off |
| **OVP ON** LED lights up | Overvoltage shutdown is activated (oUP parameter in device setup menu = on) |
| **OCP ON** LED lights up | Overcurrent shutdown is activated (oCP parameter in device setup menu = on) |

### Display A

Standard display: measured voltage value Uout, display function is changed by pressing the SELECT A key or by turning the rotary knob. Adjust resolution (select decimal place) with the ◁ and ▷ scroll keys

### Select A

Display selection:
**Uout** → Uset → OVset → Pset




### Mains Switch

| | |
|---|---|
| **POWER** LED lights up | Device is switched on |
| **POWER** switch | Switches the device on and off |

### Power Output On/Off Key

| | |
|---|---|
| **OUTPUT** LED lights up | Output is active |
| **OUTPUT** switch | Switches the power output on and off |

### Rotary Encoder for Voltage

**Voltage setpoint Uset – adjust output voltage Uset**
**Condition:** UL_L (lower setting limit) ≤ Uset ≤ UL_H (upper setting limit)

When the rotary encoder is activated the display is switched to Uset (LED) and the cursor becomes active – the selected decimal place blinks at the display and can be selected with the ◁ and ▷ scroll keys.
The new setpoint becomes effective immediately.

| Uset adjusting alternatives | Activate by turning the rotary encoder, or select with Select A Uset | |
|---|---|---|
| Scroll keys | ◁ ▷: select decimal place | △▽: immediately increase or reduce Uset |
| Numeric keypad | Entry of numeric values, Uset LED blinks | Execute with ↵, or abort with ESC |

* valid as from revision level 02 and firmware version 004. In the case of hardware revision level < 02, the LED lights up yellow in both cases.

### Display B

Standard display: measured current value Iout, display function is changed by pressing the SELECT A key or by turning the rotary knob. Adjust resolution (select decimal place) with the ◁ and ▷ scroll keys.

### Select B

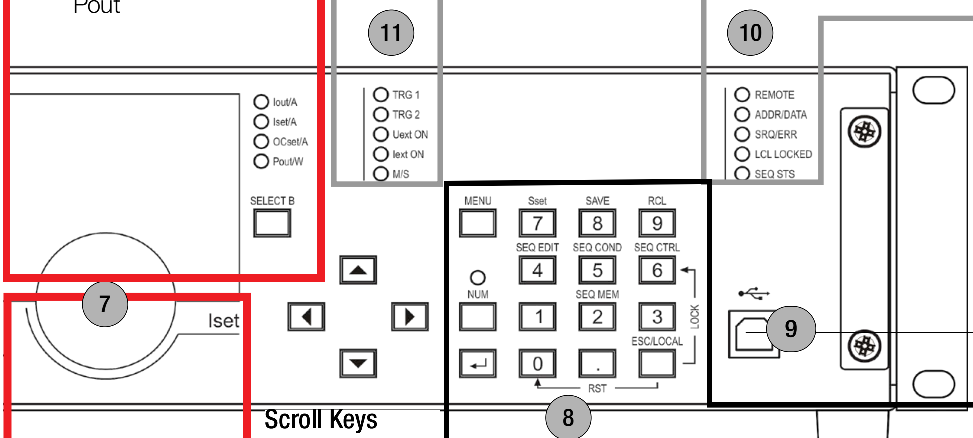
Display selection:
**Iout** → Iset → OCset → Pout

### Status Displays

| | |
|---|---|
| **TRG1** LED lights up | Trigger signal 1 is active |
| **TRG2** LED lights up | Trigger signal 2 is active |
| **Uext ON** LED lights up | Voltage input via analog interface is active |
| **Iext ON** LED lights up | Current input via analog interface is active |
| **M/S** LED lights up | Master cascading function |

### Device Status Displays

| | |
|---|---|
| **REMOTE** LED lights up | Remote control is active |
| **ADDR/DATA** LED lights up | Addressing / data transmission is active |
| **SRQ/ERR** LED lights up | Service request / error |
| **LCL LOCKED** LED lights up | Control panel is disabled |
| **SEQ STS** LED lights up | Sequence function in HOLD status |
| blinks | Sequence is active (RUN) |




### Computer Interface

USB port

### Scroll Keys

- △ Increase Uset, Iset or parameter values
- ▽ Reduce Uset, Iset or parameter values
- ◁ Select entry position or scroll within the main menu level
- ▷ Select entry position or scroll within the main menu level

### Numeric Keypad – Menu Functions

| | |
|---|---|
| MENU | Adjustment of parameters and functions |
| Sset | Switching function: display and adjust signal level |
| SAVE | Save basic device settings (device parameters) |
| RCL | Recall basic device settings |
| SEQ ... | Sequence functions: **EDIT**, **COND**ITION, **C**ON**TR**O**L**, **MEM**ORY |
| NUM | Numeric entry, if active the ENTER LED lights up: |
| ↵ | transfer setting value or acknowledge selection |
| ESC/LOCAL | Return from menu level to standard display, abort of entry, ... |
| Lock | ESC/LOCAL + SEQ CTRL: disable control panel,<br>press and hold ESC longer than 4 seconds: enable control panel |
| RST | ESC/LOCAL + 0: reset device settings to default values |

### Rotary Encoder for Current

**Current setpoint Iset – adjust output current setpoint**

**Condition:** IL_L (lower setting limit) ≤ Iset ≤ IL_H (upper setting limit)

When the rotary encoder is activated, the display is switched to Iset (LED) and the cursor becomes active – the selected decimal place blinks at the display and can be selected with the ◁ and ▷ scroll keys The new setpoint becomes effective immediately.

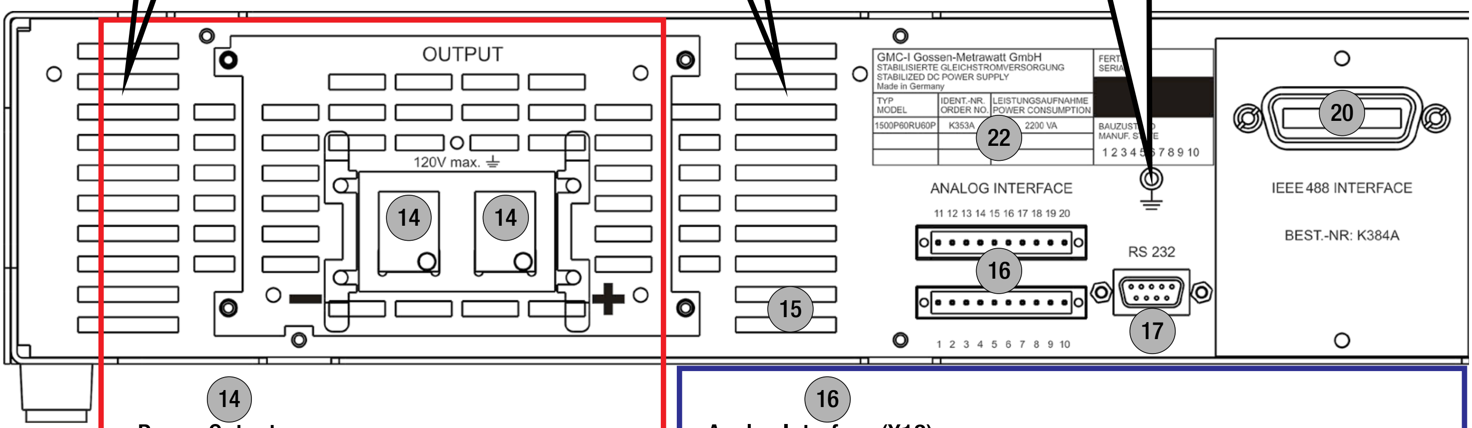
| **Iset adjusting alternatives** | **Activate by turning the rotary encoder, or select with Select B Iset** | |
|---|---|---|
| Scroll keys | ◁ ▷: select decimal place | △▽: immediately increase or reduce Iset |
| Numeric keypad | Entry of numeric values, Uset LED blinks | Execute with ↵, or abort with ESC |

### Air Vents

In order to assure adequate cooling of the device, the outlet vents for the integrated fans may not be covered.

### Ground Terminal (earth terminal)

The output or cable shields can be grounded here if shielded cables or control cables are used for the analog interface.




14

### Power Output

Terminals for connecting the power consumer. This is a floating output and can be grounded with the positive or the negative pole.

**Output connections may only be connected and disconnected when the output is inactive (OUTPUT OFF)! Danger of arcing!**

### Connecting the Power Consumer

The output leads are connected to the terminal blocks by means of ring-type cable lugs with the included M6 x 10 screws. Measurement cables can be additionally connected to the 4 mm holes.

- Remove the safety cap.
- Connect the output leads to the terminal blocks with the provided screws and washers.
- An adequate wire cross-section and correct polarity must be assured. It is advisable to twist the output leads and to identify polarity at both ends.
- Avoid exerting excessive force at the terminals.
- Align the leads to the openings in the safety cap.
- Snap the safety cap back into place.

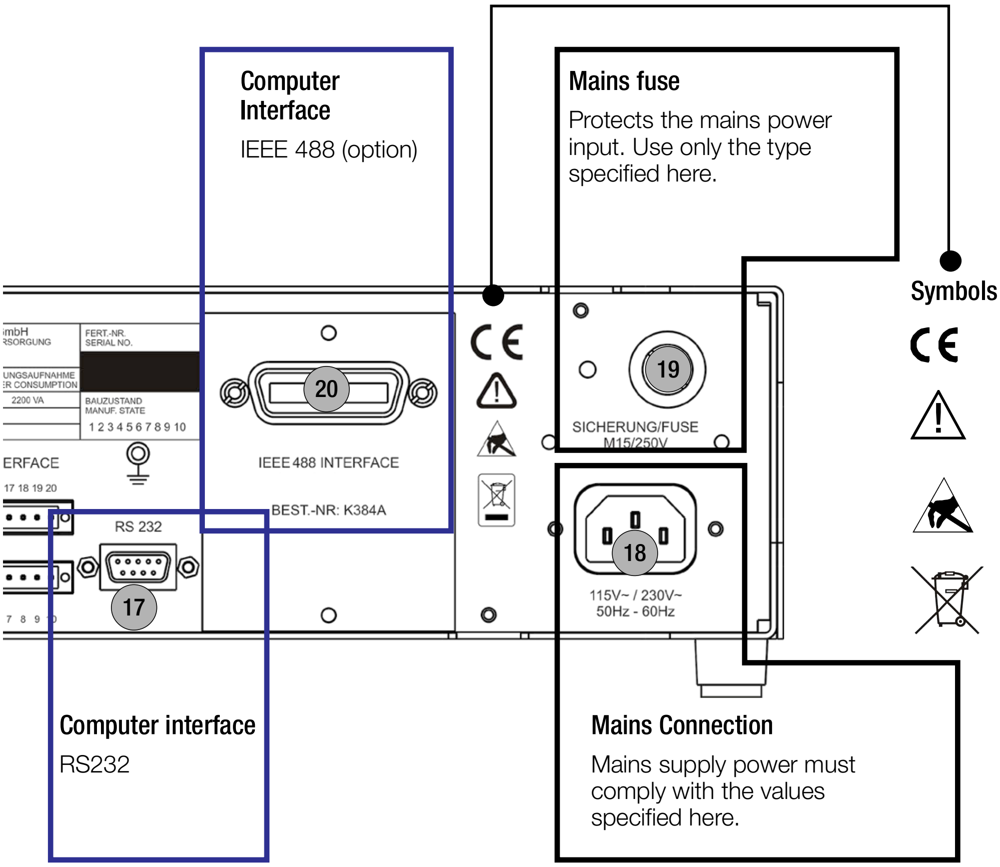
**In order to prevent danger during use, shock-proof connector cables must be used when connecting power consumers.**

16

### Analog Interface (X13)

- Remote control for output voltage and current
- External measurement of output voltage and current
- Connection of sensing leads in order to compensate for voltage drops in the output leads
- Linking of several devices in a master cascading
- Vary internal output resistance
- Control of a selected device function via the floating trigger input

| Terminal | | Allocation | Meaning |
|---|---|---|---|
| Bottom Row of Terminals | 1 | TRG 1 + | Trigger input 1, plus |
| | 2 | TRG 1 – | Trigger input 1, minus |
| | 3 | TRG 2 + | Trigger input 2, plus |
| | 4 | TRG 2 – | Trigger input 2, minus |
| | 5 | SIG 1 + | Signal output 1, collector |
| | 6 | SIG 1 – | Signal output 1, emitter |
| | 7 | SIG 2 + | Signal output 2, collector |
| | 8 | SIG 2 – | Signal output 2, emitter |
| | 9 | SIG 3 + | Signal output 3, collector |
| | 10 | AGND 2 | Auxiliary power AGND via fusing resistor 2 |
| Top Row of Terminals | 12 | +15 V | Auxiliary power, +15 V |
| | 12 | AGND 1 | Auxiliary power AGND via fusing resistor 1 |
| | | | |
| | 14 | Uext + | External control voltage for analog voltage setpoint (plus); U(Uext+); Uana = +ku x U(Uext+) |
| | 15 | Uext – | External control voltage for analog voltage setpoint (minus); U(Uext-); Uana = -ku x U(Uext-) |
| | | | |
| | 15 | Iext + | External control voltage for analog current setpoint (plus); U(Iext+); Iana = +ki x U(Iext+) |
| | 16 | Iext – | External control voltage for analog current setpoint (plus); U(Iext+); Iana = +ki x U(Iext+) |
| | 17 | U MON | Voltage monitor with reference to AGND 1 |
| | 18 | I MON | Current monitor with reference to AGND 1 |
| | 19 | SENSE + | Sensing input, plus |
| | 20 | SENSE – | Sensing input, minus |




**Symbols**

| | |
|---|---|
| CE | Indicates EC conformity |
| ⚠ | Warning concerning a point of danger (attention: observe documentation!) |
| | Observe ESDS directives |
| | The device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE. |

| | Current | | | | | | |
|---|---|---|---|---|---|---|---|
| **Length** | **30 A** | **40 A** | **60 A** | **90 A** | **120 A** | **150 A** | **180 A** |
| 1 m | 0.5 | 0.7 | 1.0 | 1.6 | 2.1 | 2.6 | 3.1 |
| 2 m | 1.0 | 1.4 | 2.1 | 3.1 | 4.1 | 5.2 | 6.2 |
| 3 m | 1.6 | 2.1 | 3.1 | 4.7 | 6.2 | 7.8 | 9.3 |
| 4 m | 2.1 | 2.8 | 4.1 | 6.2 | 8.3 | 10.3 | 12.4 |
| 5 m | 2.6 | 3.4 | 5.2 | 7.8 | 10.3 | 12.9 | 15.5 |
| 6 m | 3.1 | 4.1 | 6.2 | 9.3 | 12.4 | 15.5 | 18.6 |
| 7 m | 3.6 | 4.8 | 7.2 | 10.9 | 14.5 | 18.1 | 21.7 |
| 8 m | 4.1 | 5.5 | 8.3 | 12.4 | 16.6 | 20.7 | 24.8 |
| 9 m | 4.7 | 6.2 | 9.3 | 14.0 | 18.6 | 23.3 | 27.9 |
| 10 m | 5.2 | 6.9 | 10.3 | 15.5 | 20.7 | 25.9 | 31.0 |
| 11 m | 5.7 | 7.6 | 11.4 | 17.1 | 22.8 | 28.4 | 34.1 |
| 12 m | 6.2 | 8.3 | 12.4 | 18.6 | 24.8 | 31.0 | 37.2 |
| 13 m | 6.7 | 9.0 | 13.4 | 20.2 | 26.9 | 33.6 | 40.3 |
| 14 m | 7.2 | 9.7 | 14.5 | 21.7 | 29.0 | 36.2 | 43.4 |
| 15 m | 7.8 | 10.3 | 15.5 | 23.3 | 31.0 | 38.8 | 46.5 |
| 16 m | 8.3 | 11.0 | 16.6 | 24.8 | 33.1 | 41.4 | 49.7 |
| 17 m | 8.8 | 11.7 | 17.6 | 26.4 | 35.2 | 44.0 | 52.8 |
| 18 m | 9.3 | 12.4 | 18.6 | 27.9 | 37.2 | 46.5 | 55.9 |
| 19 m | 9.8 | 13.1 | 19.7 | 29.5 | 39.3 | 49.1 | 59.0 |
| 20 m | 10.3 | 13.8 | 20.7 | 31.0 | 41.4 | 51.7 | 62.1 |
| 21 m | 10.9 | 14.5 | 21.7 | 32.6 | 43.4 | 54.3 | 65.2 |
| 22 m | 11.4 | 15.2 | 22.8 | 34.1 | 45.5 | 56.9 | 68.3 |
| 23 m | 11.9 | 15.9 | 23.8 | 35.7 | 47.6 | 59.5 | 71.4 |
| 24 m | 12.4 | 16.6 | 24.8 | 37.2 | 49.7 | 62.1 | 74.5 |
| 25 m | 12.9 | 17.2 | 25.9 | 38.8 | 51.7 | 64.7 | 77.6 |
| 26 m | 13.4 | 17.9 | 26.9 | 40.3 | 53.8 | 67.2 | 80.7 |
| 27 m | 14.0 | 18.6 | 27.9 | 41.9 | 55.9 | 69.8 | 83.8 |
| 28 m | 14.5 | 19.3 | 29.0 | 43.4 | 57.9 | 72.4 | 86.9 |
| 29 m | 15.0 | 20.0 | 30.0 | 45.0 | 60.0 | 75.0 | 90.0 |
| 30 m | 15.5 | 20.7 | 31.0 | 46.5 | 62.1 | 77.6 | 93.1 |

**Table: Minimum cross-section in $mm^2$ to ensure that voltage drop is lower than 1 V (1 V maximum voltage drop per conductor)**

## Control Mode Status Display

| | |
|---|---|
| **CV** LED lights up | Constant voltage regulating mode: Uout ≈ Uset |
| LED **Plim / CP*** lights up | **yellow:** Pout > Pnom (OL) **green*:** PSET < Pnom progr. (CP) |
| **CC** LED lights up | Constant current regulating mode: Iout ≈ Iset |

## Display A

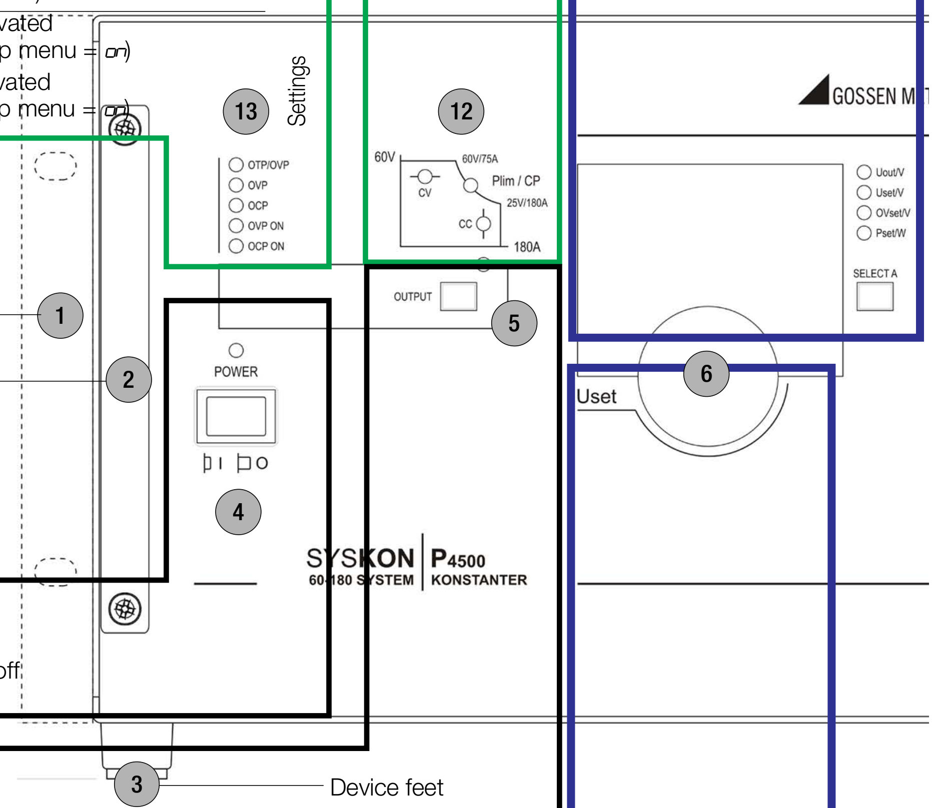
Standard display: measured voltage value Uout, display function is changed by pressing the SELECT A key or by turning the rotary knob. Adjust resolution (select decimal place) with the ◁ and ▷ scroll keys

## Select A

Display selection:
**Uout** → Uset → OVset → Pset

## Protective Functions and Status Displays

| | |
|---|---|
| **OTP/OVP** LED lights up | Overtemperature protection triggered or output voltage ≥ 80 V exceeded, ⇨ OUTPUT = off |
| **OVP** LED lights up | Overvoltage detection triggered, oUSEt and oUdLY parameter values exceeded (prerequisite: oUP parameter = on) ⇨ OUTPUT = off |
| **OCP** LED lights up | Overcurrent detection triggered, oCSEt and oCdLY parameters exceeded (prerequisite: oCP parameter = on) ⇨ OUTPUT = off |
| **OVP ON** LED lights up | Overvoltage shutdown is activated (oUP parameter in device setup menu = on) |
| **OCP ON** LED lights up | Overcurrent shutdown is activated (oCP parameter in device setup menu = on) |




## Mains Switch

| | |
|---|---|
| **POWER** LED lights up | Device is switched on |
| **POWER** switch | Switches the device on and off |

## Power Output On/Off Key

| | |
|---|---|
| **OUTPUT** LED lights up | Output is active |
| **OUTPUT** switch | Switches the power output on and off |

## Rotary Encoder for Voltage

**Voltage setpoint Uset – adjust output voltage Uset**

**Condition:** UL_L (lower setting limit) ≤ Uset ≤ UL_H (upper setting limit)

When the rotary encoder is activated the display is switched to Uset (LED) and the cursor becomes active – the selected decimal place blinks at the display and can be selected with the ◁ and ▷ scroll keys.
The new setpoint becomes effective immediately.

| Uset adjusting alternatives | Activate by turning the rotary encoder, or select with Select A Uset | |
|---|---|---|
| Scroll keys | ◁ ▷: select decimal place | △▽: immediately increase or reduce Uset |
| Numeric keypad | Entry of numeric values, Uset LED blinks | Execute with ↵, or abort with ESC |

* valid as from revision level 02 and firmware version 004. In the case of hardware revision level < 02, the LED lights up yellow in both cases.

### Display B

Standard display: measured current value Iout, display function is changed by pressing the SELECT A key or by turning the rotary knob. Adjust resolution (select decimal place) with the ◁ and ▷ scroll keys.

### Select B

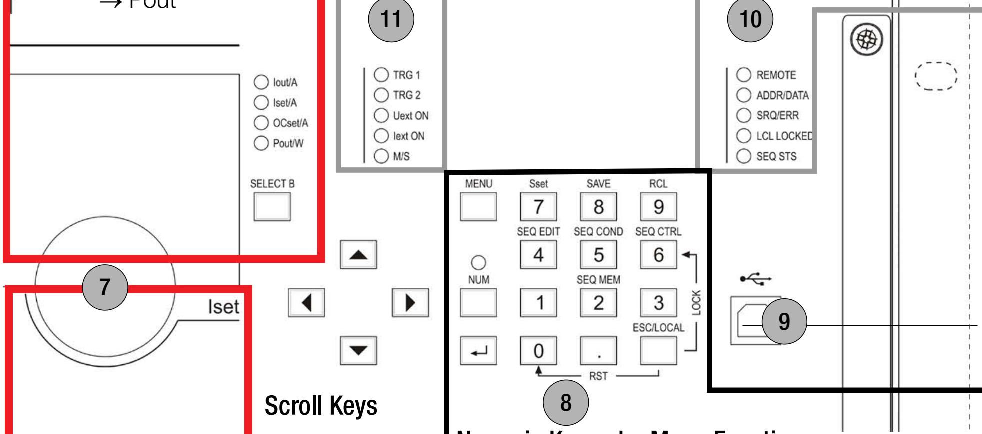
Display selection: **Iout** → Iset → OCset → Pout

### Analog Interface / Status Displays

| | |
|---|---|
| **TRG1** LED lights up | Trigger signal 1 is active |
| **TRG2** LED lights up | Trigger signal 2 is active |
| **Uext ON** LED lights up | Voltage input via analog interface is active |
| **Iext ON** LED lights up | Current input via analog interface is active |
| **M/S** LED lights up | Master cascading function |

### Device Status Displays

| | |
|---|---|
| **REMOTE** LED lights up | Remote control is active |
| **ADDR/DATA** LED lights up | Addressing / data transmission is active |
| **SRQ/ERR** LED lights up | Service request / error |
| **LCL LOCKED** LED lights up | Control panel is disabled |
| **SEQ STS** LED lights up | Sequence function in HOLD status |
| blinks | Sequence is active (RUN) |




### Computer Interface

USB port

### Scroll Keys

△ Increase Uset, Iset or parameter values

▽ Reduce Uset, Iset or parameter values

◁ Select entry position or scroll within the main menu level

▷ Select entry position or scroll within the main menu level

### Numeric Keypad – Menu Functions

| | |
|---|---|
| MENU | Adjustment of parameters and functions |
| Sset | Switching function: display and adjust signal level |
| SAVE | Save basic device settings (device parameters) |
| RCL | Recall basic device settings |
| SEQ ... | Sequence functions: **EDIT**, **CONDI**TION, **CONTROL**, **MEM**ORY |
| NUM | Numeric entry, if active the ENTER LED lights up: |
| ↵ | transfer setting value or acknowledge selection |
| ESC/LOCAL | Return from menu level to standard display, abort of entry, ... |
| Lock | ESC/LOCAL + SEQ CTRL: disable control panel, press and hold ESC longer than 4 seconds: enable control panel |
| RST | ESC/LOCAL + 0: reset device settings to default values |

### Rotary Encoder for Current

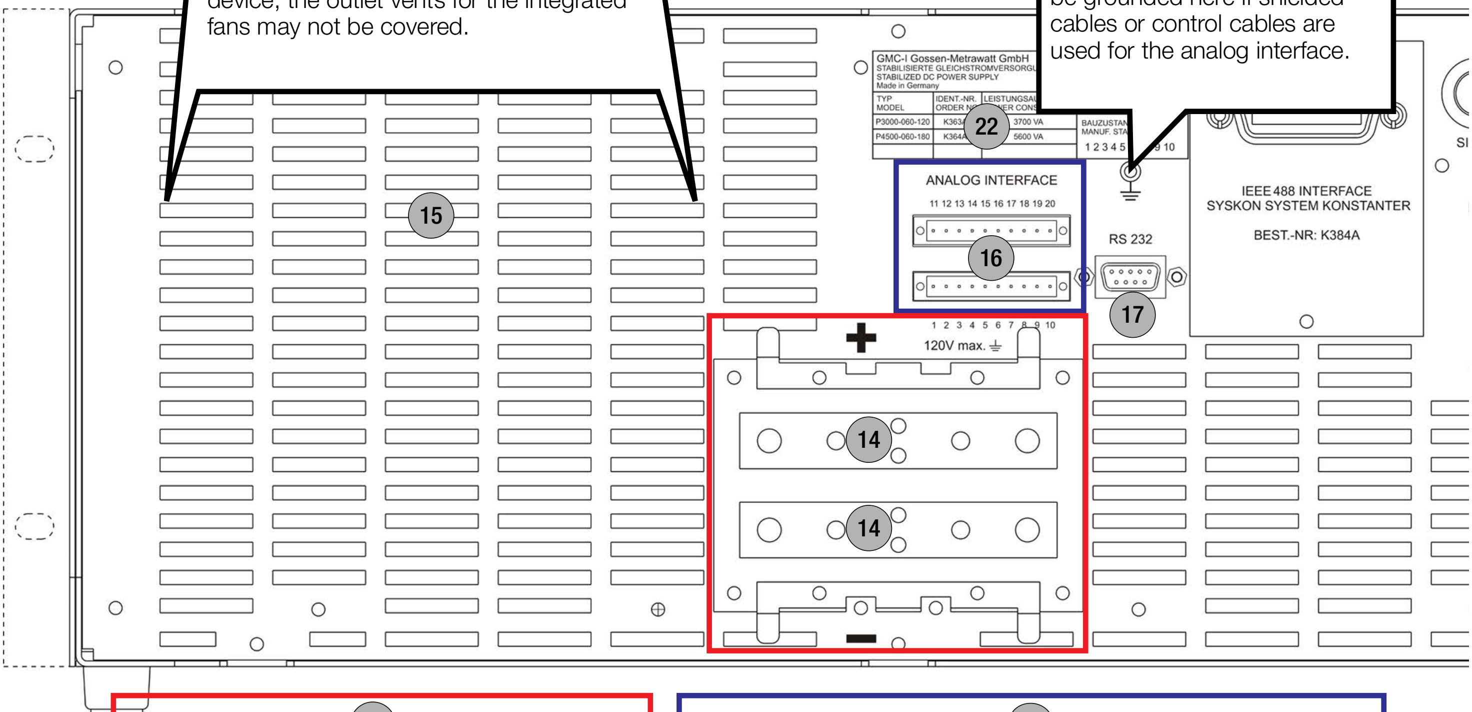
**Current setpoint Iset – adjust output current setpoint**

**Condition:** IL_L (lower setting limit) ≤ Iset ≤ IL_H (upper setting limit)

When the rotary encoder is activated, the display is switched to Iset (LED) and the cursor becomes active – the selected decimal place blinks at the display and can be selected with the ◁ and ▷ scroll keys The new setpoint becomes effective immediately.

| **Iset adjusting alternatives** | **Activate by turning the rotary encoder, or select with Select B Iset** | |
|---|---|---|
| Scroll keys | ◁ ▷: select decimal place | △▽: immediately increase or reduce Iset |
| Numeric keypad | Entry of numeric values, Uset LED blinks | Execute with ↵, or abort with ESC |

## 5.4 Rear Panel SYSKON P3000, P4500




**Air Vents**

In order to assure adequate cooling of the device, the outlet vents for the integrated fans may not be covered.

**Ground Terminal (earth terminal)**

The output or cable shields can be grounded here if shielded cables or control cables are used for the analog interface.

### Power Output (14)

Terminals for connecting the power consumer.

This is a floating output and can be grounded with the positive or the negative pole.

**Output connections may only be connected and disconnected when the output is inactive (OUTPUT OFF)! Danger of arcing!**

### Connecting the Power Consumer

The output leads are connected to the terminal blocks by means of ring-type cable lugs with the included M6 x 10 screws. Measurement cables can be additionally connected to the 4 mm holes.

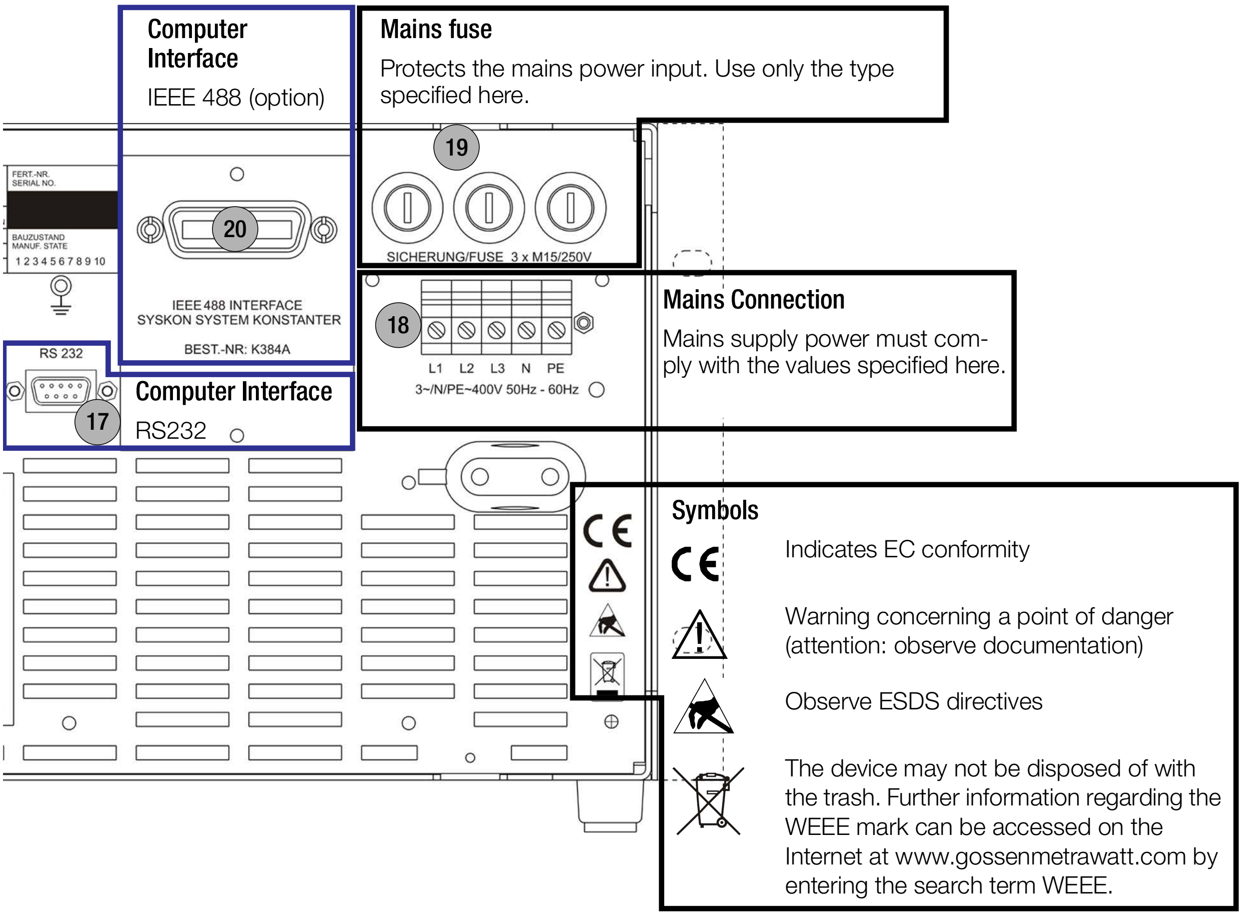
- Remove the safety cap.
- Connect the output leads to the terminal blocks with the provided screws and washers.
- An adequate wire cross-section and correct polarity must be assured. It is advisable to twist the output leads and to identify polarity at both ends.
- Avoid exerting excessive force at the terminals.
- Align the leads to the openings in the safety cap.
- Snap the safety cap back into place.

**In order to prevent danger during use, shock-proof connector cables must be used when connecting power consumers.**

### Analog Interface (X13) (16)

- Remote control for output voltage and current
- External measurement of output voltage and current
- Connection of sensing leads in order to compensate for voltage drops in the output leads
- Linking of several devices in a master cascading
- Vary internal output resistance
- Control of a selected device function via the floating trigger input

| Terminal | | Allocation | Meaning |
|---|---|---|---|
| Bottom Row of Terminals | 1 | TRG 1 + | Trigger input 1, plus |
| | 2 | TRG 1 – | Trigger input 1, minus |
| | 3 | TRG 2 + | Trigger input 2, plus |
| | 4 | TRG 2 – | Trigger input 2, minus |
| | 5 | SIG 1 + | Signal output 1, collector |
| | 6 | SIG 1 – | Signal output 1, emitter |
| | 7 | SIG 2 + | Signal output 2, collector |
| | 8 | SIG 2 – | Signal output 2, emitter |
| | 9 | SIG 3 + | Signal output 3, collector |
| | 10 | AGND 2 | Auxiliary power AGND via fusing resistor 2 |
| Top Row of Terminals | 12 | +15 V | Auxiliary power, +15 V |
| | 12 | AGND 1 | Auxiliary power AGND via fusing resistor 1 |
| | | | |
| | 14 | Uext + | External control voltage for analog voltage setpoint (plus); U(Uext+); Uana = +ku x U(Uext+) |
| | 15 | Uext – | External control voltage for analog voltage setpoint (minus); U(Uext-); Uana = -ku x U(Uext-) |
| | | | |
| | 15 | Iext + | External control voltage for analog current setpoint (plus); U(Iext+); Iana = +ki x U(Iext+) |
| | 16 | Iext – | External control voltage for analog current setpoint (plus); U(Iext+); Iana = +ki x U(Iext+) |
| | 17 | U MON | Voltage monitor with reference to AGND 1 |
| | 18 | I MON | Current monitor with reference to AGND 1 |
| | 19 | SENSE + | Sensing input, plus |
| | 20 | SENSE – | Sensing input, minus |




| | Current | | | | | | |
|---|---|---|---|---|---|---|---|
| Length | 30 A | 40 A | 60 A | 90 A | 120 A | 150 A | 180 A |
| 1 m | 0.5 | 0.7 | 1.0 | 1.6 | 2.1 | 2.6 | 3.1 |
| 2 m | 1.0 | 1.4 | 2.1 | 3.1 | 4.1 | 5.2 | 6.2 |
| 3 m | 1.6 | 2.1 | 3.1 | 4.7 | 6.2 | 7.8 | 9.3 |
| 4 m | 2.1 | 2.8 | 4.1 | 6.2 | 8.3 | 10.3 | 12.4 |
| 5 m | 2.6 | 3.4 | 5.2 | 7.8 | 10.3 | 12.9 | 15.5 |
| 6 m | 3.1 | 4.1 | 6.2 | 9.3 | 12.4 | 15.5 | 18.6 |
| 7 m | 3.6 | 4.8 | 7.2 | 10.9 | 14.5 | 18.1 | 21.7 |
| 8 m | 4.1 | 5.5 | 8.3 | 12.4 | 16.6 | 20.7 | 24.8 |
| 9 m | 4.7 | 6.2 | 9.3 | 14.0 | 18.6 | 23.3 | 27.9 |
| 10 m | 5.2 | 6.9 | 10.3 | 15.5 | 20.7 | 25.9 | 31.0 |
| 11 m | 5.7 | 7.6 | 11.4 | 17.1 | 22.8 | 28.4 | 34.1 |
| 12 m | 6.2 | 8.3 | 12.4 | 18.6 | 24.8 | 31.0 | 37.2 |
| 13 m | 6.7 | 9.0 | 13.4 | 20.2 | 26.9 | 33.6 | 40.3 |
| 14 m | 7.2 | 9.7 | 14.5 | 21.7 | 29.0 | 36.2 | 43.4 |
| 15 m | 7.8 | 10.3 | 15.5 | 23.3 | 31.0 | 38.8 | 46.5 |
| 16 m | 8.3 | 11.0 | 16.6 | 24.8 | 33.1 | 41.4 | 49.7 |
| 17 m | 8.8 | 11.7 | 17.6 | 26.4 | 35.2 | 44.0 | 52.8 |
| 18 m | 9.3 | 12.4 | 18.6 | 27.9 | 37.2 | 46.5 | 55.9 |
| 19 m | 9.8 | 13.1 | 19.7 | 29.5 | 39.3 | 49.1 | 59.0 |
| 20 m | 10.3 | 13.8 | 20.7 | 31.0 | 41.4 | 51.7 | 62.1 |
| 21 m | 10.9 | 14.5 | 21.7 | 32.6 | 43.4 | 54.3 | 65.2 |
| 22 m | 11.4 | 15.2 | 22.8 | 34.1 | 45.5 | 56.9 | 68.3 |
| 23 m | 11.9 | 15.9 | 23.8 | 35.7 | 47.6 | 59.5 | 71.4 |
| 24 m | 12.4 | 16.6 | 24.8 | 37.2 | 49.7 | 62.1 | 74.5 |
| 25 m | 12..9 | 17.2 | 25.9 | 38.8 | 51.7 | 64.7 | 77.6 |
| 26 m | 13.4 | 17.9 | 26.9 | 40.3 | 53.8 | 67.2 | 80.7 |
| 27 m | 14.0 | 18.6 | 27.9 | 41.9 | 55.9 | 69.8 | 83.8 |
| 28 m | 14.5 | 19.3 | 29.0 | 43.4 | 57.9 | 72.4 | 86.9 |
| 29 m | 15.0 | 20.0 | 30.0 | 45.0 | 60.0 | 75.0 | 90.0 |
| 30 m | 15.5 | 20.7 | 31.0 | 46.5 | 62.1 | 77.6 | 93.1 |

**Table: Minimum cross-section in mm$^2$ to ensure that voltage drop is lower than 1 V (1 V maximum voltage drop per conductor)**

# 6 Menu Structure and Parameters

| MENU | Main Menu Level: Display A | Display B | Submenu Level: Display A | Display B | Parameter Level: Display A | Display B | Parameter Level: Display A | Display B |
|---|---|---|---|---|---|---|---|---|
| | SEtUP | dEUi c | dEUi c | Li nit | UL_L | 00.00 | UL_H (A) | 60.000 |
| | **SETUP DEVICE** | | Limit value parameter | | Voltage setting limit values, L = lower, U = upper | | | |
| | Setup menu | | dEUi c | oUP | oUP (B) | on | oUdLY | 00.00 |
| | | | Overvoltage menu | | Overvoltage protection on/off | | Overvoltage delay time | |
| | | ESC | dEUi c | oCP | oCP | oFF | oCdLY | 00.00 |
| | | | Overcurrent menu | | Overcurrent protection on/off | | Overcurrent delay time | |
| | | | dEUi c | CFG_d | Pon | rSt | SSEt 7 | oFF |
| | | | | | Device settings after power on | | | |
| | SEtUP | dPY IF | dPY IF | dPY | dPY-A | Uo | dPY-b | Io |
| | **SETUP DISPLAY & INTERFACE** | | Digital display settings | | Display A – standard display: Uo | | Display B – standard display: Io | |
| | Display and interface menu | | dPY IF | An IF | trG-1 | oFF | trG-2 | oFF |
| | | ESC | Analog interface settings | | Trigger input 1 on/off | | Trigger input 2 on/off | |
| | | | dPY IF | bUS | Addr | 12 | bAUd | 9600 |
| | | | Interface settings | | Device address [6] (IEEE 488) | | Transmission speed (RS 232) | |
| | SEtUP | SEq | SEq | ctrL | SEq 6 | Go | SEq | HoLd |
| | **SETUP SEQUENCE** | | Access sequence | | Start sequence (RUN), **footnote** [3] | | Stop sequence | |
| | Sequence menu | | SEq | Condi | SEq-n 5 | 0 | Strt | 0097 |
| | | | Sequence settings | | Sequence no.(subsequence) **footnote** [1] | | Start address | |
| | | ESC | SEq | Edit | MEM-A 4 | 0 100 | USEt | 39.000 |
| | | | Edit sequence | | | | Voltage setpoint | |
| | | | SEq | MEM | LoAd 2 | 0 105 | StorE | 0 105 |
| | | | Storage operations | | Load sequence value | | Save as sequence value | |
| | SEtUP | MEAS | MEAS | MM-UI | MM-UI | oFF | U_ | 9.992 |
| | **SETUP MEASUREMENT** | | EXTREME MEASUREMENT | | Min-Max memory | | Minimum measured voltage value | |
| | Measuring menu | | MEAS | UI-CS | MEAS | UI_CS | Uc_ | 0.000 |
| | | ESC | | | | | | |
| | | | MEAS | CFG_M | M-LP | 3 | M-tAb | |
| | | | MEAS | SPEc | rLOAd **footnote** [5] | 30..531 | | |
| | AUX | | InFo | | L-Err | 000 | ErA | 3 |
| | **AUXILIARY** | | Events and status memory | | Last error no. | | Events memory A | |
| | Memory and calibration menu | | UErSi | | rEL | 01.001 | UPd | no |
| | | ESC | Firmware release | | Firmware version | | Firmware update | |
| | | | AdJUS | 7.10.11 | UoFF | # | UFS | # |
| | | | Balancing routine | Balancing date | Voltage setpoint zero point | | Voltage setpoint upper limit | |

## A Set parameter (example: upper limit value for voltage setpoint)

| Display | Keys | Action |
|---|---|---|
| UL_H 60000 | ↵ | Acknowledge selection |
| UL_H 60000 | ◁ ▷ | Select entry position (decimal place). Number blinks, NUM LED key lights up. |
| UL_H 40000 | △ ▽ | Increase/reduce value – alternative: Enter value directly with the numeric keypad. |
| UL_H 40000 | ↵ | Acknowledge parameter or abort with ESC |
| | ESC | Jump back to higher menu level. |

## B Select parameter – switch function on/off.

| Display | Keys | Action |
|---|---|---|
| oUP oFF | ↵ | Acknowledge selection |
| oUP on | △ ▽ | Select status (here: off, on, r01 … r12/r15*) |
| oUP on | ↵ | Acknowledge parameter |

* /r15 as of firmware version 004

## Key

| Symbol | Meaning |
|---|---|
| SEtUP SEq | LED display (display A/B) |
| SEtUP SEq (grey) | Parameter not yet set |
| # | Setting value is displayed, after which the measured value is entered and acknowledged with ↵. |
| ◁ ▷ | Scroll within the parameters level, select parameters |
| ↵ | Select submenu or parameters level |
| ESC | Jump back to higher menu level |
| 6 | Hot key for direct parameter selection |

| Parameter Level | | Parameter Level | | Parameter Level | | Parameter Level | | Parameter Level | | Parameter Level | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Display A | Display B | Display A | Display B | Display A | Display B | Display A | Display B | Display A | Display B | Display A | Display B |
| IL_L | 00.00 | IL_H | 60.000 | | | | | | | | |
| Current setting limit value, L = lower, U = upper | | | | | | | | | | | |
| oUSEt | 40.000 | | | | | | | | | | |
| Overvoltage protection trigger value | | | | | | | | | | | |
| oCSEt | 80.000 | | | | | | | | | | |
| Overcurrent protection trigger value | | | | | | | | | | | |
| Si nh | oFF | C-dYn | r | SAUE 8 | 01 | rcL 9 | 01 | t 16 | 1420 | 2006 | 0804 |
| | | | | | | Footnote 4 | | Footnote 5 | Time (hhmm) | Year (YYYY) | M/D (mmdd) |
| | | | | | | | | | | | |
| ddc | 15 | | | | | | | | | | |
| Display delay time | | | | | | | | | | | |
| SiG-1 | oFF | SiG-2 | oFF | SiG-3 | oFF | A I_U | oFF | A I_I | oFF | | |
| Signal input 1 on/off | | Signal input 2 on/off | | Signal input 3 on/off | | Voltage input on/off | | Current input on/off | | | |
| db | 8 | Pb | nonE | Sb | 1 | USb | 115.2k | | | | |
| Number of data bits (RS 232) | | Parity bit (RS 232) | | Stop bits (1 or 2) (RS 232) | | Transmission speed (USB COM port) | | | | | |
| | Footnote 2 | | | | | | Footnote 2 | | | | |
| SEq | cont | SEq | StoP | SEq | Strt | SEq | StEP | SEq | bStP | SEq | ESc |
| Resume sequence | | Stop sequence | | Jump to start address | | Forward step-by-step | | Backwards step-by-step | | Exit sequence | |
| StoP | 0123 | rEP | cont | tdEF | 1.000 | | | | | | |
| Stop address | | Repeat sequence | | Default time | | | | | | | |
| ISEt | 10.000 | tSEt | tdEF | FSEt | nF | | | | | | |
| Current setpoint | | Dwell time | Default time | Function | | | | | | | |
| SEq_c | 0105 | SEq_c | St-SP | SEq_r | 0101 | SEq_i | 0108 | | | | |
| Clear memory location 105 | | Clear start-stop memory location | | Remove memory location & shift | | Insert memory location & shift | | | | | |
| | | | | | | | | | | | |
| U- | 9.998 | I_ | 0.204 | I- | 0.212 | | | | | | |
| Max. measured voltage value | | Min. measured current value | | Max. measured current value | | | | | | | |
| Uc- | 60.000 | Ic_ | 0.000 | Ic | 60.000 | | | | | | |
| | | | | | | | | | | | |
| M-cFG | | EM_U | | EM_I | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Erb | 0 | ErC | 0 | CrA | 1 | crb | 0 | | | | |
| Events memory B | | Events memory C | | Status memory A | | Status memory B | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| IoFF | # | IFS | # | | | | | | | | |
| Current setpoint zero point | | Current setpoint upper limit | | | | | | | | | |
| ◁ | ▷ | | | | | | | | | | |

**Additional key functions:**
With sequence status RUN (after GO or CONT)

- ⏎ [ENTER] HOLD
- ESC [ESC] Abort at current location *
- 0 [0] Abort and jump to final value

With sequence status STOP (after Strt, Hold, StEP or bStP)

- [UP] STEP
- [DOWN] BACKSTEP
- ⏎ [ENTER] CONT
- ESC [ESC] Abort at current location *
- 0 [0] Abort and jump to final value

See sequence status diagram chap. 10.3

* Activating a rotary encoder or a SELECT key also aborts the sequence at its current location. (sequence status READY)

1 Allows for viewing and processing of the following “condi (condition) parameters” in the setup memory n specified by “Seq-n” (application: subsequences)

2 Entry of numeric value n# is additionally possible, start address ≤ n ≤ stop address, → resume sequence at memory location n#

3 Other display options can be selected while a sequence is being executed with the ◁ and ▷ keys:
The display does not return automatically to the standard display setting with this option, but rather only after the sequence function has been completed or aborted.

| | | < Selected standard display setting |
|---|---|---|
| MEM-A | 0005 | Current memory location address |
| rrEP | cont | Remaining number of repetitions |
| SEq-n | 00 | The run is part of the main sequence |
| FSEt | __rU | Sequence function parameter |
| tSEt | tdEF | Memory location-specific dwell time |
| USEt ● | ISET ● | e.g. calculated intermediate values for a ramp function |
| Uout ● | IOUt ● | Momentary measured values |

4 The ◁ and ▷ keys can be used as follows for scrolling while a selected RCL function is being executed (displays A and B blink until the selection is acknowledged with the ENTER key, or until the function is otherwise aborted).

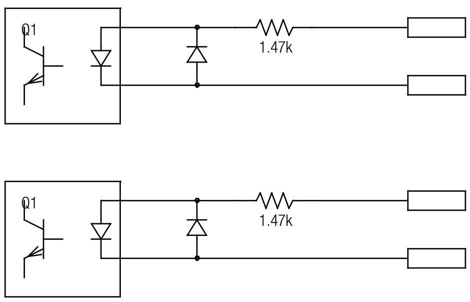
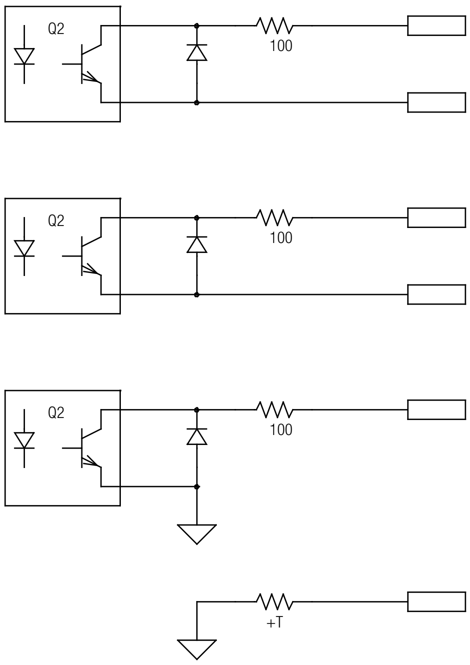
| | | |
|---|---|---|
| rcL | 02 | Access setup register 02 |
| outP | on | |
| USEt | 12.000 | |
| ISEt | 25.000 | |
| PSEt | 1500.0 | |
| ouP | on | |
| oUSEt | 80.00 | |
| oCP | oFF | |
| oCSEt | 80.00 | |
| Pon | rSt | |
| trG-1 | oFF | |
| trG-2 | oFF | |
| A I-U | oFF | |
| A I-I | oFF | |
| Strt | 0001 | |
| StoP | 0005 | |

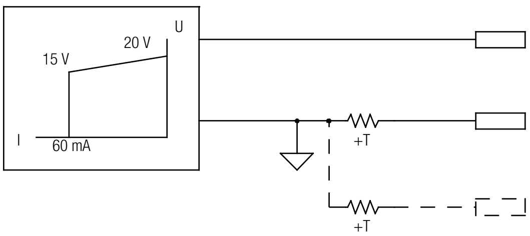
5 Display function doesn’t automatically switch back to “standard display”.

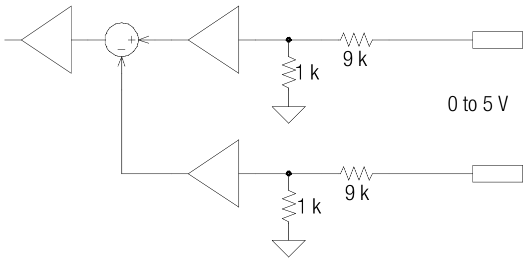
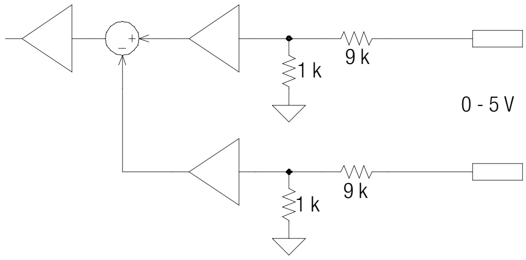
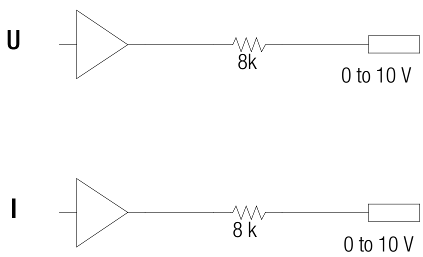
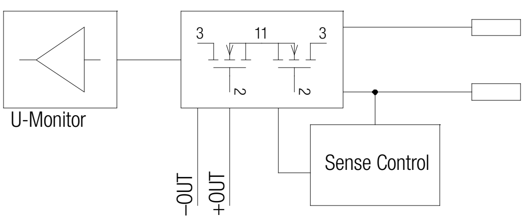
6 Changes to the device address don’t take effect until the KONSTANTER has been restarted.

# 7 Analog Interface

## 7.1 Connector Pin Assignments

| Interface Type | Circuit Diagram | Function | Terminal | Meaning |
|---|---|---|---|---|
| TRG |  | TRG 1 + | 1 | **Trigger Inputs**<br>• Floating, digital control inputs for controlling a device function defined by SEtUP/dPYIF/AnIF/trG 1 txt and SEtUP/dPYIF/AnIF/trG 2 txt.<br>• Low signal: –18 V ≤ Us ≤ + 1 V<br>• High signal: + 4 V ≤ Us ≤ + 18 V<br>• Current consumption: Is = (Us – 2 V) / 1.47 kΩ |
| | | TRG 1 – | 2 | |
| | | TRG 2 + | 3 | |
| | | TRG 2 – | 4 | |
| SIG |  | SIG 1 + | 5 | **Signal Outputs**<br>• Two floating digital status signal outputs<br>• One digital status signal output with reference to AGND (2)<br>• SIG±, SIG 2± and SIG 3+ indicate the statuses defined by SEtUP/dPYIF/AnIF/SiG 1 txt, SEtUP/dPYIF/AnIF/SiG 2 txt and SEtUP/dPYIF/AnIF/SiG 3 txt.<br>• Signal type: open collector<br>• Max. switching voltage: 30 V DC<br>• Max. switching current: 20 mA |
| | | SIG 1 – | 6 | |
| | | SIG 2 + | 7 | |
| | | SIG 2 – | 8 | |
| | | SIG 3 +, | 9 | |
| | | AGND 2 | 10 | |

| Interface Type | Circuit Diagram | Function | Terminal | Meaning |
|---|---|---|---|---|
| $U_H$ |  | +15 V | 11 | **+15 V (output)**<br>• This auxiliary voltage output (15 to 18.5 V DC with reference to AGND 1 or AGND 2) can be used to control the trigger inputs, or to supply power to external components (e.g. reference element for generating control voltages).<br>• The output is equipped with electronic current limiting to approximately 60 mA, and is short-circuit proof to AGND 1 and AGND 2.<br>**AGND 1 and AGND 2 (analog ground = reference point)**<br>• Reference point for the analog and digital control inputs and outputs<br>• Each of these terminals are internally connected to the minus pole of the power output via reversible fuses with a rating of 110 mA.<br>**The following is recommended:**<br>• Use AGND 1 as a reference for the analog terminals on the upper terminal strip (pins 13 through 18)<br>• Use AGND 2 as a reference for the digital terminals on the bottom terminal strip (pins 1 through 9) |
| | | AGND 1 | 12 | |
| | | AGND 2 | 10 | |

| Interface Type | Circuit Diagram | Func-tion | Terminal | Meaning |
|---|---|---|---|---|
| $U_{set}$ |  | Uext +<br><br>Uext – | 13<br><br>14 | **Uext +, Uext – (input)**<br>• Analog (differential) voltage input with reference to AGND for controlling the output voltage setpoint.<br>The following applies with activated analog setpoint (SEtUP/dPYIF/AnIF/AI_U on):<br>Uset = USET + ku x U(Uext +) – ku x U(Uext –)<br>Uset = Resulting output voltage setpoint<br>USET = Voltage setpoint which has been selected manually or digitally<br>U(Uext+) = External control voltage (0 … 5 V ≙ 0 … +Usetnom) with reference to AGND 1<br>U(Uext –) = External control voltage (0 … 5 V ≙ 0 … –Usetnom) with reference to AGND 1<br>ku = Control coefficient = Usetnom / 5 V<br>Usetnom = 60 V (SYSKON P1500-060-060)<br>• Input impedance: a total of 10 kΩ each to AGND (1) |
| $I_{set}$ |  | Iext +<br><br>Iext – | 15<br><br>16 | **Iext +, Iext – (input)**<br>• Analog (differential) voltage input with reference to AGND for controlling the output current setpoint.<br>The following applies with activated analog setpoint (SEtUP/dPYIF/AnIF/AI_I on):<br>Iset = ISET + ki x U(Iext +) – ki x U(Iext –)<br>Iset = Resulting output current setpoint<br>ISET = Current setpoint which has been selected manually or digitally<br>U(Iext +) = External control voltage (0 … 5 V ≙ 0 … +Isetnom) with reference to AGND 1<br>U(Iext –) = External control voltage (0 … 5 V ≙ 0 … –Isetnom) with reference to AGND 1<br>ki = Control coefficient = Isetnom / 5 V<br>Isetnom = 60 A (SYSKON P1500-060-060)<br>• Input impedance: a total of 10 kΩ each to AGND (1) |
| Monitor |  | U MON<br><br>I MON | 17<br><br>18 | **U MON (output)**<br>• Analog voltage output with reference to AGND (1).<br>Voltage is proportional to output voltage Uout detected by the sensing leads.<br>0 … 10 V ≙ 0 … Uoutnom.<br>Uoutnom = 60 V (SYSKON P1500-060-060)<br>• The output has an internal resistance of 8 kΩ and is short-circuit proof.<br><br>**I MON (output)**<br>• Analog voltage output with reference to AGND (1).<br>Voltage is proportional to internally measured output current Iout.<br>0 … 10 V ≙ 0 … Ioutnom.<br>Ioutnom = 60 A (SYSKON P1500-060-060).<br>• The output has an internal resistance of 8 kΩ and is short-circuit proof. |
| Sense |  | SENSE +<br><br>SENSE – | 19<br><br>20 | **SENSE +, SENSE – (input)**<br>• For connection of sensing leads for 4-wire operation – allows for compensation of voltage drops (up to 2 x 1 V) at long leads.<br>• Switching to 4-wire operation take place automatically when the SENSE – lead is connected to the appropriate output pole or negative load pole. |

## 7.2 Sensing Mode

### Function

Output voltage values required for voltage measuring and control circuits can be acquired directly at the consumer instead of at the output terminals with the help of the SENSE + and SENSE – sensing lead terminals at the analog interface. The sensing mode (remote sensing) offers the following advantages:

- In the constant voltage regulating mode, current related voltage drops occurring in the output leads have practically no effect on voltage supplied to the consumer. Voltage at the output terminals is automatically increased to compensate for voltage drops.
- In the constant current regulating mode, voltage limiting at the consumer is independent of output current.
- Since the voltage value provided by the measuring function is relative to the voltage value acquired at the sensing leads, load parameters such as power consumption and load resistance can be more accurately determined.

The parameters and limit values included in figure 7.2, and in the chapter entitled “Electrical Data”, apply to operation with the sensing leads.

### Connection

- The two sensing lead terminals at the analog interface (SENSE + and SENSE –) must be connected to their respective output poles at the desired point (generally speaking as close to the consumer as possible).
- It’s advisable to twist and/or shield the sensing leads in order to minimize interference (connect shield to ground terminal of negative output pole).
- Long output and sensing lead impedances may result in control fluctuations at the output, especially with capacitive consumers. This effect can be counteracted by connecting capacitors (CS+, CS-) between the SENSE and output terminals (see figure 7.2). If the output leads are twisted, their impedance can be reduced as well.
- Incorrect connection of the sensing leads does not damage the KONSTANTER, although it results in the following reversible events:
  - Polarity reversal at sensing leads or interrupted output lead: If output voltage is not being limited at the KONSTANTER by means of current regulation, it climbs to well above the selected value which finally triggers overvoltage protection and immediately deactivates the output.
  - Interrupted SENSE + lead:
    Voltage between the output terminals increases by approximately 15%.
  - Interrupted SENSE – lead:
    The sensing terminals are deactivated (automatic return to local sensing).

If the sensing leads have been connected incorrectly, increasing voltage between the output terminals is not acquired by the measuring function.

| | |
|---|---|
| Cs+, Cs- | = 10 µF to 220 µF |
| Us+, Us- | ≤ 1 V |
| Is+ | ≈ $U_{outS}$ / 180 kΩ |
| Is– | ≈ 0.3 mA |

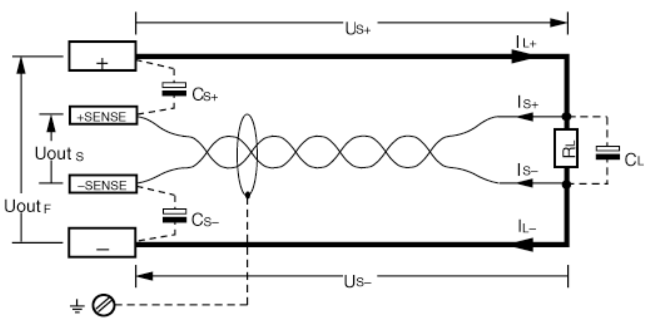



*Figure 7.2 Connecting the Consumer for Sensing Mode Operation*

### Activation

- The remote sensing mode function is activated automatically after the SENSE – terminal has been connected to the corresponding output pole.
- The function is deactivated by once again interrupting this connection.

## 7.3 Status Signal Outputs

### Function

- The KONSTANTER is equipped with three digital open collector outputs for indicating status.
  - Two floating outputs: SIG 1 ± and SIG 2 ±
  - One with reference to AGND:SIG 3 +
- The device status or event to be indicated is independent for all three signal outputs.
  Selection is made by setting the following functions:
  - SEtUP/dPYIF/AnIF/SiG-1 txt
  - SEtUP/dPYIF/AnIF/SiG-2 txt
  - SEtUP/dPYIF/AnIF/SiG-3 txt
    (see chap. 6, “Menu Structure” and chap. 8, “Operating Commands”).
- As a status signal for monitoring devices
- For controlling external output relays

### Application

- Triggering of certain device functions can be synchronized by means of connection to the trigger inputs of other KONSTANTERs.

### Connection

- Connection Values
  Max. switching voltage: 30 V DC
  Max. switching current: 20 mA
- If the signal outputs will be used to send status signals to external monitoring devices, pull-up resistors are required in order to generate the appropriate levels.
  The status signal outputs can be connected to the + 15 V terminal with pull-up resistors (at least 1 kΩ), in order to generate an active high signal of + 15 V.

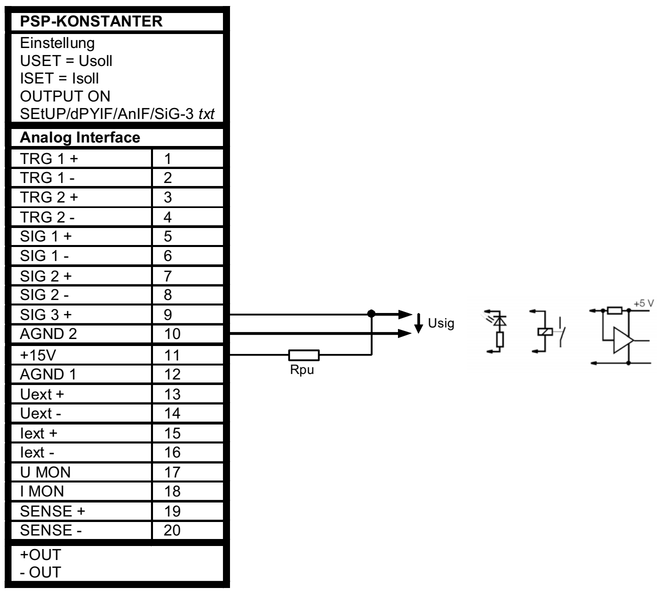



*Figure 7.3 Wiring Examples for Status Signal Outputs*

### Setting Parameters for Status Signal Outputs

| txt | Meaning – Allocation | Level |
|---|---|---|
| OFF | SIG n: direct off | Passive high |
| ON | SIG n: direct on | Active low |
| OUT | OUTPUT ON | Passive high |
| | OUTPUT OFF | Active low |
| MODE | OFF or CV | Passive high |
| | CC or OL | Active low |
| SEQ | READY/STOP | Passive high |
| | RUN | Active low |
| SSET | OFF | Passive high |
| | ON | Active low |
| U_LO [1] | Umeas ≥ w1 | Passive high |
| | Umeas < w1 | Active low |
| U_HI [1] | Umeas ≤ w2 | Passive high |
| | Umeas > w2 | Active low |
| I_LO [1] | Imeas ≥ w3 | Passive high |
| | Imeas < w3 | Active low |
| I_HI [1] | Imeas ≤ w4 | Passive high |
| | Imeas > w4 | Active low |

[1] The signal outputs can be logically linked using the comparison function. The reference values are defined by parameters w1, w2, w3 and w4 from the UI_C_SET command. Momentary measured voltage and current values are compared with these parameters and evaluated.

## 7.4 Regulating Output Voltage

### Function

Output voltage Uout can be set by means of external control voltage Usu = U(Uext +) – U(Uext –) via control inputs Uext + (non-inverting) and Uext – (inverting).

- The voltage control input functions as a differential voltage input:
- The following applies with activated analog setpoint (SEtUP/dPYIF/AnIF/AI_U on):

  Uset = USET + ku x U(Uext +) – ku x U(Uext –)

  Uset = Resulting output voltage setpoint
  USET = Voltage setpoint which has been selected manually or digitally
  U(Uext +) = External control voltage (0 … 5 V ≙ 0 … +Usetnom) with reference to AGND (1)
  U(Uext –) = External control voltage (0 … 5 V ≙ 0 … –Usetnom) with reference to AGND (1)
  ku = Control coefficient = $U_{setnom}$ / 5 V
  $U_{setnom}$ = 60 V (SYSKON P1500-060-060)
- Max. adjusting error:
  SYSKON P1500: ± 0.2% Unom ± 0.6% setpoint value
  SYSKON P3000: ± 0.25% Unom ± 0.6% setpoint value
  SYSKON P4500: ± 0.25% Unom ± 0.6% setpoint value
- Input resistance: 10 kΩ each

### Notes

- The control inputs are not floating inputs: Their reference point, AGND (1), is connected to the negative pole of the power output.
- Connecting grounded circuits to the control input may result in erroneous adjustments due to leakage current or ground loops.
- If the reference point of control voltage Usu is connected to the negative output pole at the load side, the inverting input must be connected to this point (connection b in figure 7.4). Influences resulting from voltage drops in the output lead are thus avoided.
- If control voltage is isolated from the output, connect Uext – to AGND (1) (connection a in figure 7.4).
- If remote adjustment of output voltage is to be accomplished by means of a potentiometer, wiring can be laid out as shown in figure 7.4.
- Usu can also be applied as an alternating voltage, for example in order to superimpose manually selected direct voltage USET with interference signals. The maximum operating frequency of modulated output voltage depends upon voltage amplitude, the settings selected for current limiting and load, and thus cannot be defined with a simple formula. It's increased as amplitude is decreased, and as current limiting and load are increased.

### Connection

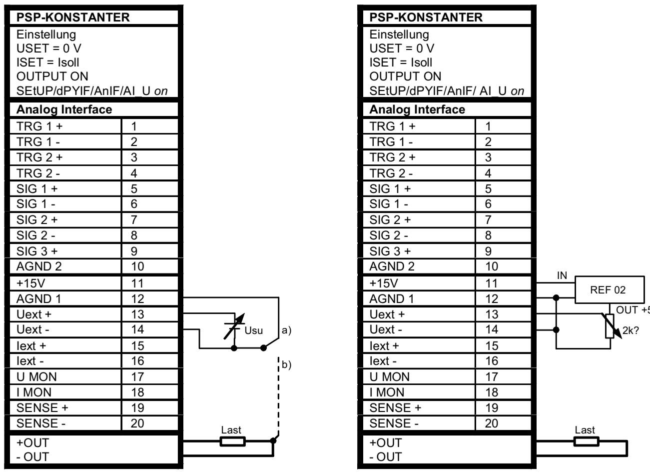



*Figure 7.4 Wiring for Controlling Output Voltage with External Voltage / External Potentiometer*

## 7.5 Controlling Output Current

### Function

Output current Iout can be set with external voltage Usi = U(Iext +) – U(Iext –) via control inputs Iext + (non-inverting) und Iext – (inverting).

- The current control input functions as a differential voltage input:
- The following applies with activated analog setpoint (SEtUP/dPYIF/AnIF/AI_I on):

  Iset = ISET + ki x U(Iext +) – ki x U(Iext –)

  Iset = Resulting output current setpoint
  ISET = Current setpoint which has been selected manually or digitally
  U(Iext +) = External control voltage (0 … 5 V ≙ 0 … +Isetnom) with reference to AGND (1)
  U(Iext –) = External control voltage (0 … 5 V ≙ 0 … –Isetnom) with reference to AGND (1)
  ki = Control coefficient = Isetnom / 5 V
  $I_{setnom}$ = 60 A (SYSKON P1500-060-060)
- Max. adjusting error:
  SYSKON P1500: ± 0.2% Inom ± 1.2% setpoint value
  SYSKON P3000: ± 0.15% Inom ± 1.2% setpoint value
  SYSKON P4500: ± 0.133% Inom ± 1.2% setpoint value
- Input resistance: 10 kΩ each

### Notes

- The control inputs are not floating inputs: their reference point, AGND (1), is connected to the negative pole of the power output.
- Connecting grounded circuits to the control input may result in erroneous adjustments due to leakage current or ground loops.
- If the reference point of control voltage Usi is connected to the negative output pole at the load side, the inverting input must be connected to this point (connection b in figure 7.5). Influ-

ences resulting from voltage drops in the output lead are thus avoided.

- If control voltage is isolated from the output, connect Iext – to AGND (1) (connection a in figure 7.5).
- If remote adjustment of output current is to be accomplished by means of a potentiometer, wiring can be laid out as shown in figure 7.5.
- Usi can also be applied as an alternating voltage, for example in order to superimpose manually selected direct current ISET with interference signals. To a great extent, the maximum operating frequency of modulated output current depends upon the output current value, as well as the voltage amplitude which results from the prevailing load, and thus cannot be defined with a simple formula. It's increased as amplitude is decreased, and as load is increased.

### Connection

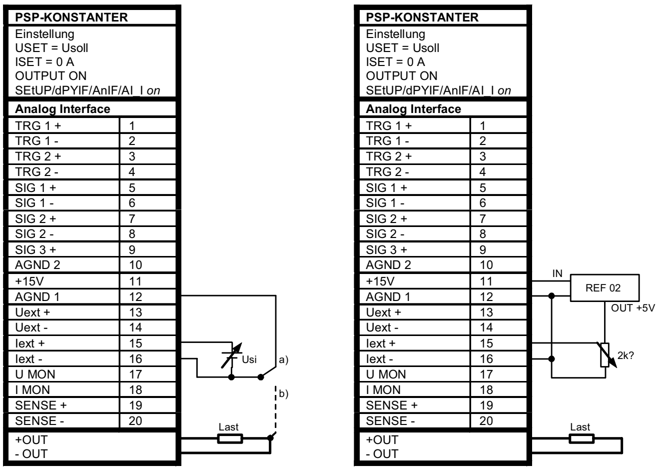



*Figure 7.5 Wiring for Controlling Output Current with External Voltage / External Potentiometer*

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**Attention !**

Control inputs Uext +, Uext – and Iext +, Iext – should only be connected with shielded cable.
Connect the shield to the AGND (1) reference point.

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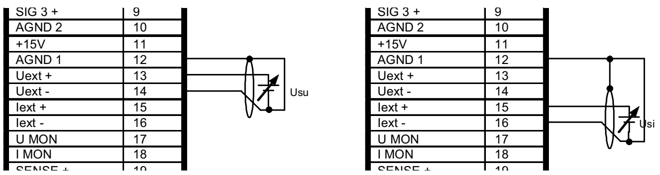



## 7.6 Voltage Monitoring Output

### Function

- The U MON terminal reads out a voltage Umu with reference to AGND (1), which is proportional to output voltage Uout.
- U MON serves as a control voltage for series master connection.
- However, U MON can also be used for external measuring, monitoring and recording.
- The following applies:
  Umu = Uout x kmu x kload (kload = 1: 0 … 10 V ≙ 0 … Uoutnom)
  kmu = 10 V / Uoutnom; U-monitor coefficient
  kload = Rload / (Rload + Ri); load coefficient
  Ri(U MON)= 8 kΩ; U-monitor internal resistance
  Rload = Load resistance (internal resistance of the measuring instrument)
  Uoutnom = 60 V (SYSKON P1500-060-060)
- Max. error for Umu/kmu (where Rload > 10 MΩ):
  SYSKON P1500: ± 0.2% Unom ± 0.4% actual value
  SYSKON P3000: ± 0.3% Unom ± 0.6% actual value
  SYSKON P4500: ± 0.3% Unom ± 0.8% actual value

### Notes

- U MON is not a floating output: its reference point, AGND (1), is connected to the negative output pole.
- Connecting grounded measuring circuits to the monitor output may result in erroneous measurements due to leakage current or ground loops.
- The voltage monitoring output makes reference to output voltage acquired at the sensing leads.
- The monitor output is short-circuit proof.
  Internal resistance is 8 kΩ.

### Connection

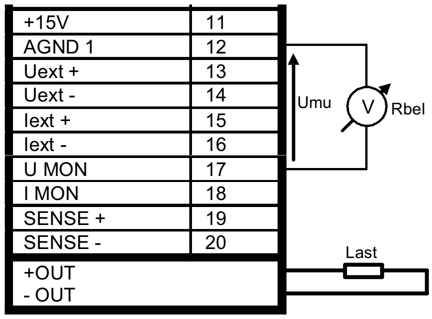



*Figure 7.6 Voltage Monitor Wiring*

## 7.7 Current Monitoring Output

### Function

- The I MON terminal reads out a voltage Umi with reference to AGND (1), which is proportional to output current Iout.
- I MON serves as a control voltage for parallel master connection.
- However, I MON can also be used for external measuring, monitoring and recording.
- The following applies:
  Umi = Iout x kmi x kload (kload = 1: 0 … 10 V ≙ 0 … Ioutnom.
  kmi = 10 V / Ioutnom; I-monitor coefficient
  kload = Rload / (Rbel + Ri); load coefficient
  Ri(I MON)= 8 kΩ; I-monitor internal resistance
  Rload = Load resistance (internal resistance of the measuring instrument)
  Ioutnom = 60 A (SYSKON P1500-060-060)
- Max. error for Umi/kmi (where Rload > 10 MΩ):
  SYSKON P1500: ± 0.3% Inom ± 1.2% actual value
  SYSKON P3000: ± 0.2% Inom ± 1.2% actual value
  SYSKON P4500: ± 0.167% Inom ± 1.2% actual value

### Notes

- I MON is not a floating output: Its reference point, AGND (1), is connected to the negative output pole.
- Connecting grounded measuring circuits to the monitor output may result in erroneous measurements due to leakage current or ground loops.
- The monitor output is short-circuit proof. Internal resistance is 8 kΩ.

### Connection

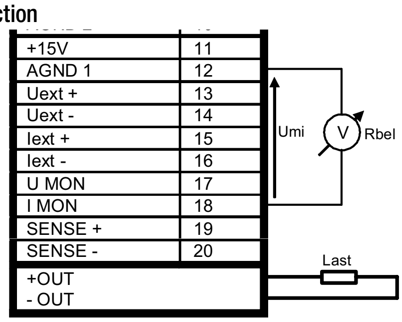



*Figure 7.7 Current Monitor Wiring*

## 7.8 Trigger Inputs

### Function

- Floating optocoupler inputs TRG 1± and TRG 2± allow for remote control of a device function with the help of a binary signal.
- The function to be controlled is selected by manually or digitally configuring the trigger mode (SEtUP/dPYIF/AnIF/trG 1 txt or SEtUP/dPYIF/AnIF/trG 2 txt).

### Connection

- Connect the control signal between TRG 1(2) + and TRG 1(2) –.

Signal level:

Low signal: – 18 V ≤ Us ≤ + 1 V

High signal: + 4 V ≤ Us ≤ + 18 V;

Current consumption: Is = (Us – 2 V) / 1.47 kΩ.

- The TRIGGER input can be driven with the + 15 V output at the analog interface via any desired switch (figure 7.8).

**WARNING !**

Trigger inputs TRG 1± and TRG 2± are floating inputs and are functionally isolated from the output current circuit.
This functional isolation is not equivalent to “safety isolation” as specified in electrical safety regulations.

### Note

The trigger inputs are sampled by the digital control unit approximately every 10 ms. After a signal change has been detected, repeated querying ensues at short time intervals (suppression of switch bouncing and interference pulses). And thus:

- Trigger signal pulses must have a minimum duration of 14 ms in order to ensure reliable recognition.
- A delay of 1 to 15 ms may occur between application of the control signal and triggering of the controlled function.

### Connection

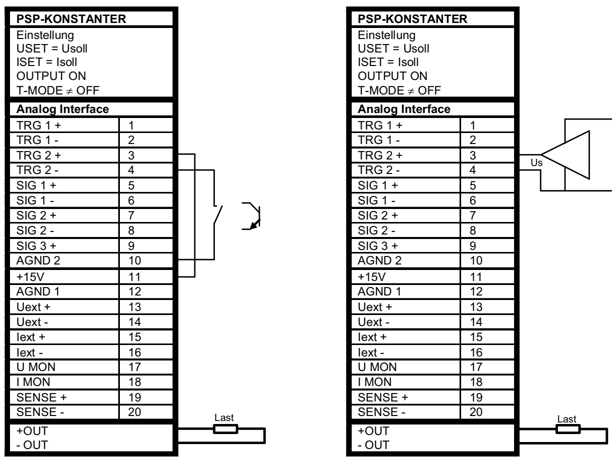



*Figure 7.8 Controlling the Trigger Input with a Switching Element / External Signal*

### Trigger Function Setting Parameters

| Parameter | | Meaning |
|---|---|---|
| OFF | | Trigger input function is deactivated, trigger signals have no effect. |
| OUT | OUTPUT | Trigger signal acts upon the OUTPUT: output on/off |
| | Low | OUTPUT depends upon manual setting or programming command |
| | Edge Low → High | OUTPUT remains OFF or OUTPUT is switched OFF |
| | High | OUTPUT is OFF and cannot be activated (neither manually nor by means of a program command). |
| | Edge High → Low | The OUTPUT is activated; exception: OTP or OVP |
| SQS | Step function | Memory recall (step-by-step sequence control) |
| | Edge Low → High | Start trigger signal |
| | High | – The trigger signal is a high pulse with a duration of less than 800 ms.<br>– A high pulse with a duration > 1.0 s resets the address counter to the start address at any point in time, and execution begins with the next trigger signal. |
| | Edge High → Low | The high → low edge of the (short) trigger signal results in step-by-step control of the currently selected sequence, regardless of the specified time and number of repetitions. Recall of the memory’s content begins with the START address. Each trigger signal increases the address by 1, until the STOP address is reached. The next pulse once again causes execution of the content of the START address. |
| SEQ | SEQUENCE | Sequence execution control |
| | Edge Low → High | The SEQUENCE function is started beginning with the start address (SEQUENCE GO) |
| | Edge High → Low | Ends sequence execution by jumping to the stop address |
| LLO | LOCAL LOCKED | Disabling of the front panel controls |
| | Low | All front panel controls are functional. |
| | High | All front panel controls are disabled except for the mains switch, and activation is not possible with the LOCAL key. |
| MIN | MINMAX | Storage of Min-Max values for U and I is controlled when the MINMAX function is activated. (MINMAX ON)(UI_ ON) |
| | Low | The Min-Max function is active. |
| | Edge Low → High | The Min-Max function is deactivated. Values in the Min-Max memories remain unchanged. |
| | High | The Min-Max function is inactive. |
| | Edge High → Low | Values in the Min-Max memories are reset and replaced with momentary output values.<br>The Min-Max function is activated. |
| AIX | Analog Input | Uext, Iext |
| | Low | Analog setpoints not switched through |
| | High | Analog setpoints switched through |
| AIU | Analog Input | Uext |
| | Low | Analog setpoint not switched through |
| | High | Analog setpoint switched through |
| AII | Analog Input | Iext |
| | Low | Analog setpoint not switched through |
| | High | Analog setpoint switched through |

## 7.9 Parallel Connection

If output current from a single KONSTANTER is insufficient for the respective application, the outputs of any number of KONSTANTERs can be parallel connected.

**Attention !**

If outputs with different nominal voltages are parallel connected, all outputs must be limited to the lowest utilized nominal voltage value. The ULIM parameter is used to select this setting.

### 7.9.1 Direct Parallel Connection

#### Function

- Easiest way to provide the consumer with more current than is available from a single r KONSTANTER.
- KONSTANTERs with differing nominal output voltages can be used. However, all voltage setpoints must be set or limited to the same value.
- This setup is less suitable for the constant voltage regulating mode.

#### Wiring

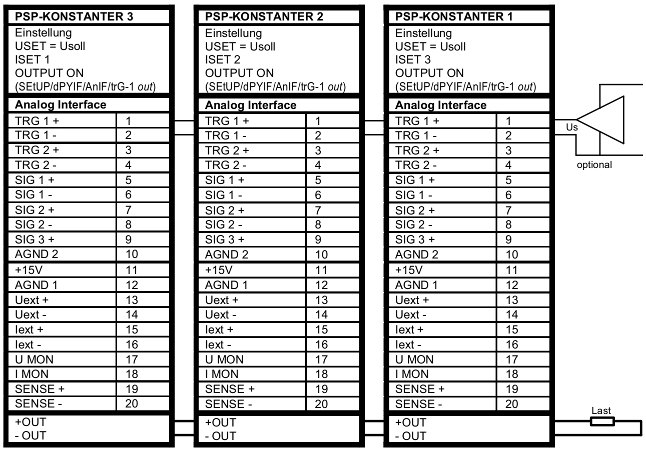



*Figure 7.9.1a Wiring for Direct Parallel Connection*

#### Settings

- Deactivate all outputs.
- Adjust voltage setpoint USET of all parallel connected KONSTANTER to approximately the same value:
- Uset = USET1 = USET2 = USET3 = … = USETn
- Adjust the current setpoints ISET such that they add up to the desired cumulative current value Iset:
- Iset = ISET1 + ISET2 + ISET3 + … + ISETn
- Activate the outputs.

#### Functional Principle

- After switching the outputs on, load current is initially supplied by the KONSTANTER with the highest voltage setting.
- If load resistance is continuously reduced, load current is continuously increased.
- When load current reaches the ISET value selected for the output which is momentarily supplying power to the consumer, current limiting is activated for this output.
- If load resistance is further decreased, current regulation reduces output voltage until the voltage value of the output with the next lowest setting is reached.
- As of this point in time, this KONSTANTER also supplies a portion of the load current.
- This procedure is continued until load current triggers current regulating at the output with the lowest voltage setting when the setpoint value for cumulative current is reached.
- This output maintains constant load current until the load resistor is short-circuited.

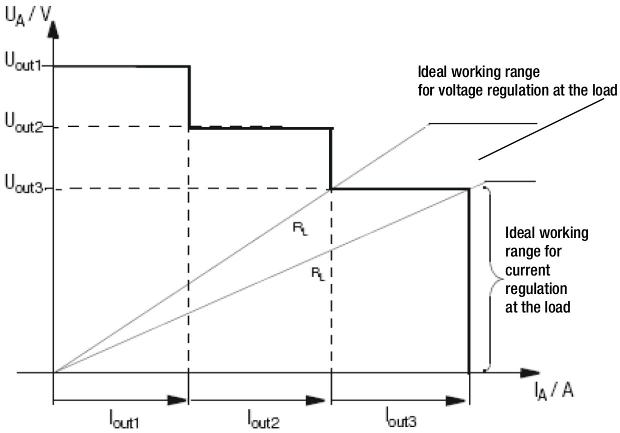



*Figure 7.9.1b U / I Diagram for Direct Parallel Connection*

#### Notes

- Slightly varying voltages occur at the individual outputs as a result of setting tolerances.
- In the event of larger voltage differences, an electronic sink is activated at the outputs with lower voltage settings.
- The sink controller attempts to reach the lower voltage value by limiting power consumption.
- Neither the KONSTANTERs nor the power consumer are damaged as a result.
- If problems occur with the measurement of load current, the KONSTANTERs should be linked by means of parallel master connection.
- The outputs can be activated and deactivated collectively by connecting the trigger inputs in parallel (see figure 7.9.1a, optional connection) or series (setting:“SEtUP/dPYIF/AnIF/trG-1 out”).

## 7.9.2 Parallel Master Connection

### Function

As opposed to direct parallel connection, parallel master connection offers significant advantages:

- Equally suitable for voltage and current regulation
- Output parameters (output voltage, cumulative current limiting) are set entirely by the master device.
- All interconnected KONSTANTERs are equally loaded.

### Wiring

- Define one power supply as a master device.
- Connect master and slaves as shown in figure 7.9.2.
- Connect the output leads.
- Balance the individual output current values. Keep connector cables as short as possible, and use the largest possible conductor cross-section. Execute balancing with Rsym (set potentiometer to approx. 2 kΩ).

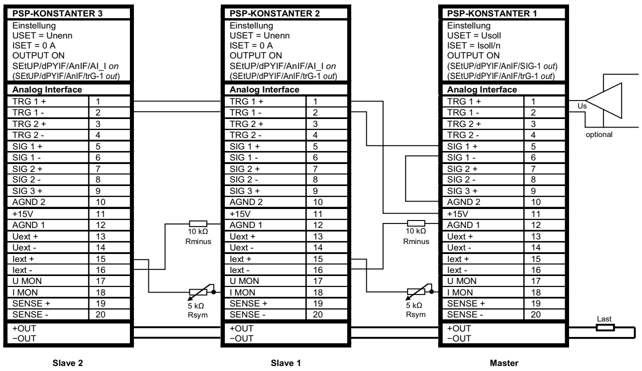



*Figure 7.9.2 Wiring for Parallel Master Connection*

### Settings

Initial power-up:

- Short circuit the load.
- Switch the master on (mains) and configure settings:

  (Pon rcl) If desired

  OUTPUT off

  USET = UsetDesired output voltage

  ISET = Iset / n

  Iset: desired cumulative output current;
  n: Number of devices
  Only valid if nominal data are identical for all devices, see notes.

- Switch slave 1 on (mains) and configure settings:

  (Pon rcl) If desired

  USET > USET master

  The voltage setpoint at the slaves must be set at least 1% higher than at the master device, e.g. to maximum.

  ISET = 0 A The ISET rotary knob can be deactivated if desired by setting ILIM to 0 A.

  SEtUP/dPYIF/AI_I on

  Activating the Analog Current Setpoint

- Use the same procedure for additional slaves.
- Press the OUTPUT ON key at the slaves and the master.
- Check output current at the slaves' displays.
- Output current at each of the slaves can be precisely matched to master output current by adjusting Rsym.
- Changes appear immediately at the respective display.
- Undo short-circuiting of the load.

From this point on, setting and regulation of (cumulative) output parameters are controlled entirely by the master device.

### Power-up after initial settings:

Devices can be switched on and off in any desired order.

### Functional Principle

The master controls output current of the downstream device (slave 1) via the its current control input with the help of the current monitoring signal.

Slave 1 functions as a master device for the next downstream slave (slave 2), and so forth.

Cumulative output current is thus always proportional to master output current.

### Notes

KONSTANTERs with Differing Nominal Values

The KONSTANTER with the smallest nominal voltage value must always be used as the master device.

The voltage setting range of the other KONSTANTERs must be limited to this lowest value with the ULIM parameter.

### General

- The current regulator's dynamics can be slowed down in order to achieve more stable performance. Select the following setting to this end "SEtUP/dEVic/CFG d/C dYn L".
- Rsym can be implemented as a 2 kΩ fixed resistor – adjusting error for the slave is increased somewhat as a result.
- A wire connection can be used instead of Rsym and Rminus can be omitted, if no precise setpoint value is required for cumulative output current. In this case, each slave supplies slightly more current than the master.
- If analog interface connector cables and the sensing leads are longer than 1 meter, shielded cable should be used. The shield is connected to the ground terminal on the housing or to – OUT.
- The master device's measuring function acquires collectively generated output voltage for all interconnected KONSTANTERs, but only acquires its own output current.
- The individual measured current values for each of the interconnected KONSTANTERs must be added together in order to arrive at cumulative output current.
- In order to assure that the slaves' OUTPUT ON status is activated along with the master's OUTPUT ON status via the signal output and trigger input circuit as shown in figure 7.9.2, "SEtUP/dPYIF/AnIF/SiG-(x1) out" must be selected at the master and "SEtUP/dPYIF/AnIF/trG-(x2) out" must be selected at the slaves – (x1) and (x2) in example 1.
  The master's OUTPUT ON status can be optionally controlled via the trigger input – setting at the master: "SEtUP/dPYIF/AnIF/trG-(x3) out", (x3) in example 1.

## 7.10 Series Connection

If output voltage from a single KONSTANTER is insufficient, or if you want to generate a ± voltage, the outputs of several KONSTANTERs can be connected in series.

**WARNING !**

Maximum allowable cumulative voltage for series connection is 240 V (or 480 V with grounded neutral point).

### 7.10.1 Direct Series Connection

**Attention !**

If outputs with differing nominal values are series connected, the highest selected current value is present at all outputs in the event of a short-circuit.
However, the internal reverse-voltage protection diode is only rated for nominal current of the respective device (see reverse voltage withstand under “Electrical Data”).
For this reason, all current setpoints must be set to the lowest nominal current value of all interconnected devices.

The ILIM parameter is used to select this setting.

#### Function

- The easiest way to supply the consumer with more voltage than is available from a single KONSTANTER
- Easy wiring
- Less suitable for the constant current regulating mode

#### Wiring

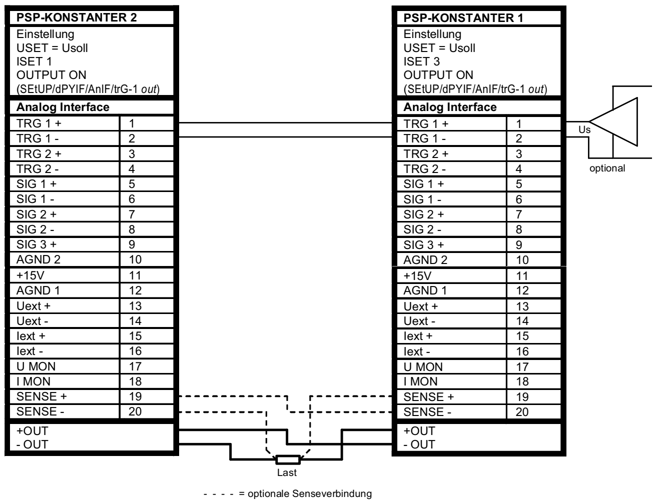



*Figure 7.10.1a Wiring for Direct Series Connection*

#### Settings

- Deactivate all outputs.
- Adjust current setpoint ISET of all series connected KONSTANTERs to approximately the same value:
- Iset = ISET1 = ISET2 = ISET3 = … = ISETn
- Adjust the voltage setpoints USET such that they add up to the desired cumulative voltage value Uset:
- Uset = USET1 + USET2 + USET3 + … + USETn
- Activate the outputs.

#### Functional Principle

The sum of all individual output voltages is made available to the consumer.

If load resistance is continuously reduced, all of the outputs deliver the same load current at first.

When load current reaches the lowest selected current setpoint value, current regulating is triggered at the respective output.

If load resistance is further reduced, this output maintains constant load current until its output voltage has dropped to 0 V.

If even further reduction of load current occurs, the affected output is forced by the other outputs to generate a negative voltage. As of approximately – 0.5 V, the internal reverse-voltage protection diode becomes conductive.

Load current can once again climb, until current regulation is activated at the output with the next higher current setpoint value.

This procedure is continued until load current triggers current regulating at the output with the highest current setpoint value.

Current is held constant by this last output until short-circuiting occurs.

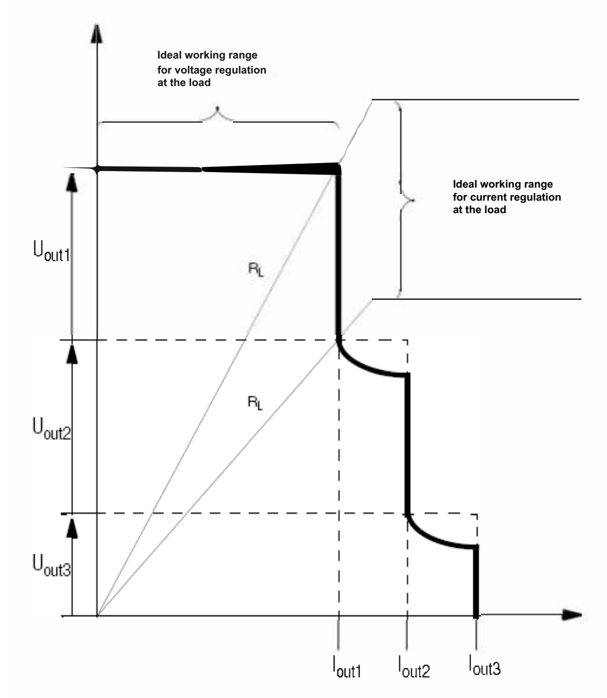



*Figure 7.10.1b U / I Diagram for Direct Series Connection*

#### Note

The outputs can be activated and deactivated collectively by connecting the trigger inputs in parallel (see figure 7.10.1a, optional connection) or series (setting:“SEtUP/dPYIF/AnIF/trG 1 out”).

### 7.10.2 Series Master Connection

#### Function

As opposed to direct series connection, series master connection offers significant advantages:

- Equally suitable for voltage and current regulation
- Output parameters (cumulative output voltage, current limiting) are set entirely by the master device.
- All interconnected KONSTANTERs are equally loaded.

#### Wiring

- Specify one power supply as the master device.
- Connect master and slave devices as shown in figure 7.10.2.
- Connect the output leads to the series circuit phase terminals.
- Balance the individual output voltage values with Rsym.

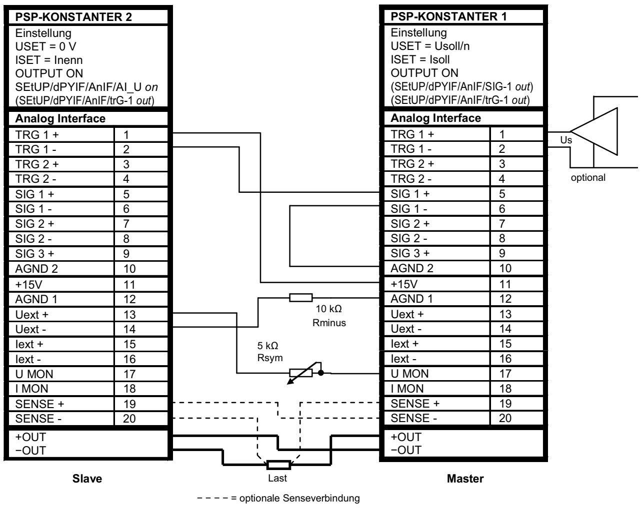



*Figure 7.10.2 Wiring for Series Master Connection*

#### Settings

Initial power-up:

- Do not load the outputs (idle).
- Switch the master on (mains) and configure settings:

  (Pon rcl) If desired

  OUTPUT off

  USET = Uset/n Uset: Cumulative output voltage
  n: Number of devices
  Only valid if nominal data are identical for all devices, see notes.

  ISET = Iset current limit value
- Switch slave 1 on and configure settings:

  (Pon rcl) If desired

  USET = 0 VThe USET rotary knob can be deactivated if desired by setting ULIM to 0 V.

  ISET > ISETmaster
  The current setpoint at the slaves must be set at least 1% higher than at the master device, e.g. to maximum.

  SEtUP/dPYIF/AI_U on
  Activating the Analog Current Setpoint
- Use the same procedure for additional slaves.
- Press the OUTPUT ON key at the master.
- Check output voltage at the KONSTANTERs' displays.
- Output voltage at each of the slaves can be precisely matched to master output voltage by adjusting Rsym. Changes appear immediately at the respective display.
- Connect the load.

From this point on, setting and regulation of (cumulative) output parameters are controlled entirely by the master device.

#### Power-up after initial settings:

Devices can be switched on and off in any desired order.

#### Functional Principle

The master controls output voltage of the downstream KONSTANTER (slave 1) via the slave's voltage control input with the help of the voltage monitoring signal.

Slave 1 functions as a master device for the next downstream slave (slave 2), and so forth.

Cumulative output voltage is thus always proportional to master output voltage.

#### Notes

KONSTANTERs with Differing Nominal Values

The KONSTANTER with the smallest nominal current value must always be used as the master device.

The current setting range of the other KONSTANTERs must be limited to this lowest value with the ILIM parameter.

#### General

- If analog interface connector cables and the sensing leads are longer than 1 meter, shielded cable should be used.
- The shield is connected to the ground terminal on the housing, or to – OUT.

#### General

- Rsym can be implemented as a 2 kΩ fixed resistor; adjusting error for the slaves is increased somewhat as a result.
- If Rminus is omitted, the standard value for Rsym is increased to 122 kΩ.
- If analog interface connector cables and the sensing leads are longer than 1 meter, shielded cable should be used. The shield is connected to the ground terminal on the housing or to – OUT.
- The same current value is available from all KONSTANTERs. For this reason, current measured at the master device only is sufficient for the measurement of load current.
- The individual measured voltage values for each of the interconnected KONSTANTERs must be added together in order to arrive at cumulative output voltage.
- In order to assure that the slaves' OUTPUT ON status is activated along with the master's OUTPUT ON status via the signal output and trigger input circuit as shown in figure 7.10.2, "SEtUP/dPYIF/AnIF/SiG-(x1) out" must be selected at the master and "SEtUP/dPYIF/AnIF/trG-(x2) out" must be selected at the slaves – (x1) and (x2) in example 1.
  The master's OUTPUT ON status can be optionally controlled via the trigger input – setting at the master: "SEtUP/dPYIF/AnIF/trG-(x3) out", (x3) in example 1.

## 7.11 Varying the Internal Output Resistance Value

### Function

In the voltage regulating mode, internal output resistance has a value of close to 0 Ω.

The internal output resistance value can be increased for certain applications, for example simulation of long output cables or weak automotive batteries. The selected (open-circuit) output voltage is reduced in proportion to increasing load (figure 7.11 a)

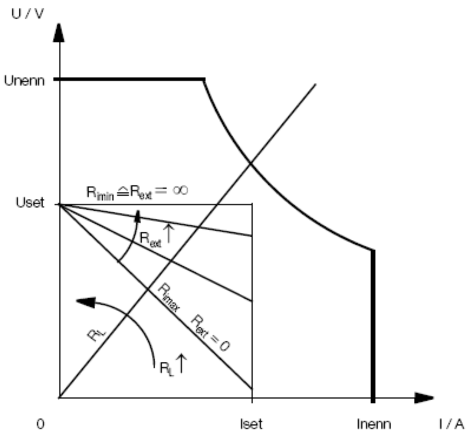



*Figure 7.11a Output Voltage with Reference to Load*

### Calculation

The following applies:

$$R_i = \frac{20k\Omega}{18k\Omega + R_{ext}} \times \Omega \qquad \text{where } \infty \geq Rext \geq 0\ \Omega$$

$$R_{ext} = \frac{20k\Omega}{R_i} \times \Omega - 18k\Omega \qquad \text{where } 0\ \Omega < Ri \leq 1.11\ \Omega$$

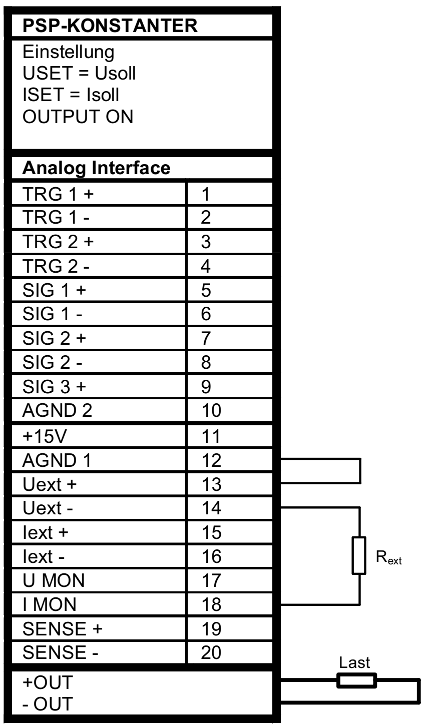



*Figure 7.11b Wiring for Varying Internal Resistance*

# 8 Descriptions of Operating Commands

All setting and query commands are described and listed alphabetically in the following pages.

Commands with * appear at the beginning of the list.

The header shows the command as an abbreviation.

Insofar as query commands exist (identified with a question mark ?), they are listed as well.

The next line (with the hand symbol) indicates how the respective command can be executed manually. If keys are required, they are mentioned as well.

The note "Menu" indicates that the respective command can be executed from the menu.

If no manual procedure for executing the command exists, this is indicated with a long dash (—).

### Information on Storage Locations

Different numbers of memory locations are possible depending on the firmware version (see table below).

| Firmware Version | Memory Locations |
|---|---|
| Version 003 | 12 SETUP memory locations<br>1536 SEQUENCE memory locations |
| Version 004 | 15 SETUP memory locations<br>1700 SEQUENCE memory locations |

### "General RESET" Function (manual only)

The "General RESET" function deletes the entire user memory: setup memory, sequence memory, interface settings.

The default values are restored (see default settings for the respective setting commands).

The following remain unchanged: device balancing parameters, manufacturing/serial number, and time and date settings.

**Attention!**
Before executing a "General RESET", be sure to make a note of your setting parameters or save them, e.g. using the STORE command.

Executing a "General RESET": Press and hold the ◁ and ▷ scroll keys during "POWER ON" until "rdy" blinks at the display.

## *CLS – Clear Status

—

### Function

The *CLS command deletes all event registers and the status byte register, except for the MAV bit (Message AVailable). Any existing service requests are cancelled.

| | |
|---|---|
| Addressing status | unchanged |
| Input and output buffers | unchanged |
| Service request SRQ | cleared |
| Status byte register STB | cleared except for MAV bit |
| Event registers ESR, ERA, ERB, ERC | cleared |
| Enable registers ESE, ERAE, ERBE, ERCE, SRE, PRE | unchanged |
| Set or stored parameters | unchanged |

The *CLS setting command also clears the error number list (first 3 parameters) in the response to the "ERROR?" query command:

"ERROR 000,000,000,xxx"

### Setting Command

Syntax: **`*CLS`**

## *DDT, *DDT? – Define Device Trigger

—

### Function

A list of commands including up to 80 characters can be entered to a register with the Define Device Trigger command. The *DDT command list is executed after receiving the *TRG device message or the IEC bus command GET (GROUP EXECUTE TRIGGER). The content of the DDT register can be read out with the *DDT? query command. Maximum response string length: 80 characters

### Setting Command

Syntax: *`DDT` ***`command`***[/***`command`***][/***`command`***] ...
|— max. 80 char. ——|

Default setting
or after RESET (*RST): DDT register cleared

Note: A slash (/) must be used as the delineating character between commands in the DDT string instead of a semicolon (;).

All specified device messages (setting and query commands) are allowable as parameters except for the *TRG command.

### Query Command

Syntax: *`DDT?`

Sample response string: **`USET 10;ISET 5.6;OUT ON`**

Note: The delineating slashes (/) are changed back to semicolons (;) in the response string.

### Comments

In order to prevent query errors, a blank (space) is returned if the DDT register is empty.

If the maximum DDT string length is exceeded, all characters in excess of the allowable number are ignored and an execution error message is generated.

The received command list is not checked for correct syntax and limit values until the trigger command is received.

If an execution error occurs, the DDT register can be read out with the *DDT? command, but its content cannot be executed (execution error message is generated again).

The DDT register is not changed or cleared when the trigger command is executed.

## *ESE, *ESE?, *PRE, *PRE?, *SRE, *SRE?, ERAE, ERAE?, ERBE, ERBE?, ERCE, ERCE? – Enable Registers

—

### Function

The enable registers determine which bit(s) from the corresponding event or status byte register is/are capable of influencing the respective group message. The respective group message remains set (1 = TRUE), as long as at least one bit which has been enabled to this end has a status of TRUE.

This allows for selective enabling or disabling of an SRQ and/or the individual status message "IST" due to an occurred event (masking).

The device is equipped with six enable registers. They can be written to and read separately. Queries, the *CLS command and device functions do not cause any changes to the contents of these registers. The registers can be cleared by entering a value of "0" (e.g. *ESE 0). The enable registers are non-volatile, and are only cleared by means of device shutdown if the non-volatile PSC flag is set to 1.

| Designation | Setting Command | Query Command |
|---|---|---|
| Event standard enable reg. (ESE) | *ESE *n* | *ESE? |
| Parallel poll enable register (PRE) | *PRE *n* | *PRE? |
| Service request enable reg. (SRE) | *SRE *n* | *SRE? |
| Event enable register A (ERAE) | ERAE *n* | ERAE? |
| Event enable register B (ERBE) | ERBE *n* | ERBE? |
| Event enable register C (ERCE) | ERCE *n* | ERCE? |

*n* = decimal equivalent of register content ($0 \leq n \leq 255$).

### Example of setting command

Syntax: **`*ESE n`**

### Example of query command

Syntax: **`*ESE`**?

Sample response string: **`*ESE`** 255

## *ESR?, ERA?, ERB?, ERC? – Event Register Query

**Menu** (for ERA?, ERB?, ERC?)

### Function

The event registers provide information concerning events which have occurred within the device since the last query. They acquire and save status changes which have occurred for specific device functions. The corresponding bit is set in the event register, when the respective event occurs.

For example, the CME command error bit is set in the ESR event standard register upon receipt of an incorrect programming command. This bit remains set, even if correct commands are subsequently transmitted to the device. The CME bit is not reset until the ESR register is queried.

The device is furnished with four 8-bit event registers, each of which can be individually queried. The content of an event register is cleared when it's queried. The *CLS command (CLEAR STATUS) can be used to clear all event registers.

| Designation | Query Command |
|---|---|
| Event standard register (ESR) | *ESR? |
| Event register A (ERA) | ERA? |
| Event register B (ERB) | ERB? |
| Event register C (ERC) | ERC? |

Each response consists of a whole number $0 \leq n \leq 255$, where *n* corresponds to the decimal equivalent of the content of the respective register.

An enable register is assigned to each event register.

## *IDN? – Device Identification Query

—

### Function

In response to this query, the device identifies itself by providing information regarding manufacturer, type designation, serial number, hardware revision level and firmware revision level.

### Query Command

Syntax: **`*IDN?`**

Sample response string:

"GMC-I GOSSEN-METRAWATT,
PSP1500P060RU060P,xxxxxxxxxxxxxxx,01.004"

*manufacturer,*
*type,serial_number,hardware_revision,software_revision*

Fixed response string length: 63 characters

## *IST? – Individual Status Query

—

### Function

Command for directly querying parallel poll information, derived from the status byte.

The status byte is not reset by this query.

### Query Command

Syntax: **`*IST?`**

Response string: **`0`** or **`1`**

## *LRN? – Device Settings Query (LEARN)

—

*LRN? reads out current device settings.

*LRN? i (i = 1 through 12/15) reads out the respective device settings which have been saved to setup memories 1 through 12/15 [for a more precise formulation refer to command *SAV 1 through 12/15]

### Function

In response to the *LRN? query command, the device supplies a list of nearly all adjustable functions along with their momentary parameter settings.

### Query Command

Syntax: **`*LRN?`**

Sample response string after *RST:

```
„OUTPUT OFF;USET +000,000;ISET
+000,000;PSET +01500.0;UL_L +000,000;UL_H
+060,000;IL_L +000,000;IL_H +060,000;OVP
ON;OVSET +080,000;OV_DELAY 00,000;OCP
OFF;OCSET +080,000;OC_DELAY 00,000;POW-
ER_ON RST;T_MODE OFF,OFF;ANALOG_IN OFF,
 OFF;SINK ON;C_DYN R;MEAS_LPF 3;MINMAX
OFF;SIG123 OFF, OFF, OFF;SSET OFF;FSET
 CLR;TDEF 00,001;TSET 00,000;START_STOP
0001.0001;REPETITION 000;DISPLAY UO, IO"
```

Variant: **`*LRN? i`**

(i) = optional parameter, specifies address in setup memory #i = 1 - 12/15. **`*LRN? i`** reads the "*LRN?" data record from SETUP memory ($01 \leq i \leq 12/15$)

Fixed response string length: 390 characters

## *OPC, *OPC? – Operation complete query

—

**Function**

The operation complete function (OPC) allows for synchronization of the controller and the device:

Information indicating whether or not the previous instructions in the command string have been processed can thus be evaluated.

There are two possible procedures:

Bit 0 is set in the *ESR register with the *OPC command.

**Setting Command**

Syntax: ***OPC**

A "1" is transmitted as a result following the *OPC? command..

**Query Command**

Syntax: ***OPC?**

**Comment**

Further evaluation options are described in the chapter entitled "Status and Events Management".

## *PSC, *PSC? – Power-On Status Clear

—

**Function**

The power-on status clear flag (PSC) determines whether or not the contents of the enable registers will be cleared when the device is shut down.

The PSC flag can be set and queried:

**Setting Command**

Syntax: ***PSC n**
Value range: n = 0, 1
Default setting
or after RESET (*RST): 0

**Query Command**

Syntax: ***PSC?**
Sample response string: **0**

**Parameters list**

| Parameter | Content | Meaning |
|---|---|---|
| n | 0 | Enable registers will not be cleared |
| | 1 | Enable registers will be cleared |

**Comment**

The PSC flag setting is retained, even after the device has been switched off or after execution of the *CLS command.

## *RCL – Recalling Stored Settings

RCL

**Function**

Settings which have been previously saved to battery-backed memory with the *SAV command (SAVE) can be recalled and activated with*RCL (RECALL).

**Comment**

The function for recalling a device setting from setup memory can be used for other commands by entering a text parameter (Rxx).

**Example:** **POWER_ON R01** means that the memory content of setup memory 1 is recalled during power-up.

**Setting Command**

Syntax: ***RCL n**

**Parameters list**

*Register number n*
n = 1 through 12/15
n = 99 (undo after *RST, *RCL #, …)
Parameter type: Number (whole number)

Recalls a parameter set from setup memory. Settings parameters stored to the specified register number are used for the current device settings. The status which was active before the **RCL n** command was executed can be restored with the **RCL 99** command.

## *RST – Reset Device Settings to Default Values

ESC/LOCAL & 0

**Function**

After executing the reset function, the device is set to its basic default configuration (see the table entitled "Adjustable Functions and Parameters" in chap. 10.1).

**Note:** A period of approximately 30 seconds should be allowed to elapse after the *RST command before the next command is executed.

**Default settings:**

```
„OUTPUT OFF;USET +000,000;ISET
+000,000;PSET +01500.0;UL_L +000,000;UL_H
+060,000;IL_L +000,000;IL_H +060,000;OVP
ON;OVSET +080,000;OV_DELAY 00,000;OCP
OFF;OCSET +080,000;OC_DELAY 00,000;POW-
ER_ON RST;T_MODE OFF,OFF;ANALOG_IN OFF,
 OFF;SINK ON;C_DYN R;MEAS_LPF 3;MINMAX
OFF;SIG123 OFF, OFF, OFF;SSET OFF;FSET
 CLR;TDEF 00,001;TSET 00,000;START_STOP
0001.0001;REPETITION 000;DISPLAY UO, IO"

UI_C_Set
+000,000.+000,000.+000,000.+000,000
```

**Setting Command**

Syntax: ***RST**

## *SAV – Saving Device Settings
SAVE

### Function
Current device settings can be saved to battery-backed memory with the *SAV (SAVE) execution command.

### Setting Command
Syntax: **`*SAV n`**

### Parameters list
*Register number n*
n = 1 through 12/15
Parameter type: Number (whole number)

### Comments
All data stored with the SAVE function are retained in battery-backed memory when the device is switched off.

## *STB? – Status Byte Register Query
—

### Function
Command for querying the status byte register (STB).

The status byte register contains:
- The status of group messages from the four event registers (bits 1, 2, 3 and 5)
- The status of the output buffer (empty → MAV bit = 0, not empty → MAV bit = 1)
- The status of MSS group messages masked with the SRE enable register from internal bits 0 through 5

This query command has been replicated to a great extent for operation with serial interface (RS 232 or USB).

Register contents can be read out:

a) **With the *STB? command:**
The response is a data string consisting of a whole number 16 ≤ *n* ≤ 127, where n corresponds to the decimal equivalent of the register's content.
With this querying method the value of *n* is always ≥ 16, because at least this response string was saved to the output buffer, and the MAV bit was thus set.

b) **By means of serial polling** (IEC bus only):
The device responds with its status byte as a "one byte message" in reply the SPE (SERIAL POLL ENABLE) addressed interface command.
With this querying method bit 6 indicates the RQS status, and is reset to "0" after completion of serial polling.

The *CLS (CLEAR STATUS) command clears the status byte register except for the MAV bit, and cancels any SRQ messages.

## *TRG – Device Trigger Function
—

### Function
A command or a list of commands which has been previously defined by means of the *DDT string (DEFINE DEVICE TRIGGER) is executed with this command.

The device accepts this command as a device message via all integrated PC interfaces.

### Setting Command
Syntax: **`*TRG`**

### Comments
If trigger action has not been defined (empty DDT memory), bit 4 (EXE, execution error) is set in the standard event register upon receipt of the device trigger command.

The *TRG command may not be used as part of the DDT command.

The DDT register is not changed or cleared when the trigger command is executed.

## *TST? – Starting the Self-Test
—

### Function
Upon receipt of the *TST? query, the device starts a self-test and reads out test results to the output buffer as a response string.

The *TST? query generates a response of either "0" (= test passed) or "1" (= test failed). If the self-test is failed, the "TCE" bit is also set in event register C.

The following is checked:

### Adjust Test
Testing is conducted to determine whether or not the device has been balanced.
If the device has not been balanced, or if the balancing procedure was interrupted, error numbers 91 and 66 are read out.

### Query Command
Syntax: **`*TST?`**
Response string: **`0`** or **`1`**

## *WAI – Wait to Continue
—

### Function
The ***WAI** command is of no significance where programming the KONSTANTER is concerned.

It serves to synchronize the interface protocol in accordance with the IEC 488.2 standard.

### Setting Command
Syntax: **`*WAI`**

## ADJUST – Balancing/Calibration Function
## ☞ Menu

### Function

**Attention!**
Executing this balancing procedure changes parameters that directly influence the accuracy of the Konstanter and the default settings are overwritten. Careful consideration should thus be given as to whether or not execution is really necessary.
Balancing at the factory is performed with highly accurate measuring instruments, as specified in the DAkkS calibration certificate.

When the ADJUST function is started, the date (format: Y.MM.DD) on which the last adjustment was performed is shown in the right-hand display.

**Attention!**
This procedure may only be executed if no other power consumers are connected. They might otherwise be damaged, because the upper range limits are read out automatically (OUTPUT ON).
The entire procedure can be executed either manually or PC controlled.

The following parameters can be balanced with this procedure:

Voltage setpoint: USET (offset value and upper range limit)
and measured voltage value: UOUT (offset value and upper range limit)

Current setpoint: ISET (offset value and upper range limit)
and measured current value: IOUT (offset value and upper range limit)

Adequately accurate measuring instruments for voltage and current are required for this procedure. The measured values must be entered as parameter W during the respective balancing step, either at the keypad or at the PC.

If balancing fails or if it's interrupted with the **ADJUST EXIT** command, appropriate error messages are generated and **UNCAL** appears at the display.

### ADJUST Procedure

The following sequence must be adhered to:
Uoff (offset value), Ufs (upper range limit), Ioff (offset value), Ifs (upper range limit)

### Setting Commands

*Voltage offset*
Syntax: **ADJUST Uoff**

The Konstanter selects a small voltage offset value.
Read measured value ***w*** at the measuring instrument and transmit it to the Konstanter with the following command.

Syntax: **ADJUST Uoff, w**

*Upper voltage range limit*
Syntax: **ADJUST Ufs**

The Konstanter sets output voltage to the upper range limit. Read measured value ***w*** at the measuring instrument and transmit it to the Konstanter with the following command.

Syntax: **ADJUST Ufs, w**

*Current offset*
Syntax: **ADJUST Ioff**

The Konstanter selects a small current offset value.

The Konstanter must be short circuited via the ammeter or connected to a suitable resistive load for current balancing.

**Attention!**
Change the test setup for current measurement with a suitable ammeter. The measuring instrument must be capable of processing the maximum occurring current value.

Read measured value ***w*** at the measuring instrument and transmit it to the Konstanter with the following command.

Syntax: **ADJUST Ioff, w**

*Upper current range limit*
Syntax: **ADJUST Ifs**

The Konstanter selects a small voltage offset value.

Read measured value ***w*** at the measuring instrument and transmit it to the Konstanter with the following command.

Syntax: **ADJUST Ifs, w**

After the procedure has been completed, the date from the internal clock is saved as a balancing date.

If the procedure is interrupted or an error occurs, an error message is generated. **UNCAL** appears in the "Adjust Menu" at the display instead of the calibration date. The balancing parameters are replaced by internally stored default values.
The ***TST?** query generates a "1".

After the next "POWER ON", the previous, most recently effective balancing parameters are re-entered with the corresponding balancing date and loaded to the device.
The ***TST?** query generates a "0".

### Interrupting the balancing procedure
Syntax: **ADJUST EXIT**

## ANALOG_IN, ANALOG_IN?
## – Activation of Analog Control Inputs Uext, Iext (Uset, Iset)
## ☞ Menu

### Function

This command allows for direct or linked activation of the analog control inputs for voltage and current.

The txt1 parameter determines the switching parameter for the Uext input, and the txt2 parameter applies to the Iext input.

The control inputs at the analog interface can be switched directly with the OFF and ON parameters.

The "ON/OFF" switching status can be set indirectly by entering the "SSET" parameter to the ANALOG_IN setting command, depending upon FSET (with the sequence function) or the SSET command.

When the switching statuses are queried, the momentary switching status (namely ON, OFF or SSET) is always returned as a response.

**Note:** When the PSET function is active, control signals Uext and Iext cannot be applied.

### Setting Command

| | |
|---|---|
| Syntax: | **ANALOG_IN txt1,txt2** |
| Parameter txt1/txt2: | OFF/ON/SSET |
| Default setting or after RESET (*RST): | OFF |

### Query Command

Syntax: **ANALOG_IN?**
Sample response string: **ANALOG_IN OFF, OFF**

## C_DYN, C_DYN? – Setting Current Regulating Dynamics
Menu

### Function

This command makes it possible to adapt the control dynamics of the current regulator to inductive loads. Correct use of this command allows for optimization of the regulator for critical load circumstances.

### Setting Command

Syntax: **`C_DYN txt`**

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | R | Full current regulating dynamics, for minimal inductive loads |
| | L | Reduced current regulating dynamics<br>for higher inductive loads or in the case of parallel connection |

### Query Command

Syntax: **`C_DYN?`**
Sample response string: **`C_DYN R`**

## CRA?, CRB? – Condition Register Query
Menu

### Function

The condition register provides information concerning the momentary status of specific device functions at the time the query was executed. For example, if the output is switched to constant current regulation, the appropriate CCR bit is set in condition register A (CRA) (condition TRUE → condition bit = 1).

This bit remains set until the current regulating mode is exited. The condition register can be queried as often as desired during this time, without causing any change to its content. The corresponding bit is not reset until the output is no longer operating in the current regulating mode (condition FALSE → conditions bit = 0).

The device is furnished with an 8-bit condition register. It can be read out, but direct overwriting and deletion are not possible.

| Designation | Query Command |
|---|---|
| Condition register A (CRA) | CRA? |
| Condition register B (CRB) | CRB? |

The response consists of a whole number $0 \leq n \leq 255$, where $n$ corresponds to the decimal equivalent of the content of the register.

### Query Command

Syntax: **`CRA?`**

Condition register A

| | | |
|---|---|---|
| D7: | SEQB | Sequence function active |
| D6: | OTP2A | Overtemperature shutdown (OTP LEVEL 2) active |
| D5: | OTP1A | Temperature signal (OTP LEVEL 1) active |
| D4: | OVPA | OVP signal active |
| D3: | OCPA | OCP signal active |
| D2: | OL | Overload |
| D1: | CCR | Output in current regulating mode |
| D0: | CVR | Output in voltage regulating mode |

### Query Command

Syntax: **`CRB?`**

Condition register B

| | | |
|---|---|---|
| D7: | TCB | TST or ADJUST/CAL function active |
| D6: | T2A | Signal at trigger input 2 of the analog interface active 2) |
| D5: | T1A | Signal at trigger input 1 of the analog interface active 2) |
| D4: | ACLL | AC-LEVEL LOW (line voltage < 182 Vrms) |
| D3: | 0 | |
| D2: | S123A | Signal output SIG1 or/and signal output SIG2 or/and signal output SIG3 at the analog interface active |
| D1: | CMPC | Measured current value not within the current tolerance band specified by UI_C_SET w1,w2,w3,w4 divided by w3,w4; ENABLE: ?MINMAX ON? |
| D0: | CMPV | Measured voltage value not within the voltage tolerance band specified by UI_C_SET w1,w2,w3,w4 divided by w1,w2; ENABLE: ?MINMAX ON? |

## DCL, SDC – Device Clear Function
—

### Function

The device clear command clears the input and output buffers at the interfaces (e.g. requested data which has not yet been picked up). Interface-internal waiting times and lockouts are cleared. The device is ready to receive data.

| | |
|---|---|
| Addressing status | unchanged |
| Input and output buffers | cleared |
| Service request SRQ | unchanged |
| Status byte register | MAV bit = 0, otherwise unchanged |
| Event registers ESR, ERA, ERB, ERC | unchanged |
| Enable registers ESE, ERAE, ERBE, ERCE, SRE, PRE | unchanged |
| Set and stored parameters | unchanged |

This command is processed:

a) As a device message via all computer interfaces (setting command) “DCL” or “SDC”

Syntax: **`DCL`**
or
Syntax: **`SDC`**

b) Via the IEC bus interface as addressed command SDC (SELECTED DEVICE CLEAR)

c) Via the IEC bus interface as universal command DCL (DEVICE CLEAR) for all bus users

## DISPLAY, DISPLAY? – Function Switching for Displays A and B
Menu

### Function

The display function makes it possible to control displays A and B separately in accordance with the table below.
If this view is exited, e.g. by selecting another parameter with SELECT, or with the rotary encoder or via the menu, the display returns to this configuration after the specified time has elapsed (DDC: see the table entitled “Adjustable Functions and Parameters” in chap. 10.1).

### Setting Command

Syntax **`DISPLAY`** ***`txt1,txt2`***
Default setting
or after RESET (*RST): UO, IO

### Parameters List

| Status | Description | Display A txt1 | Display B txt2 | Menu |
|---|---|---|---|---|
| **ON** | 7-segment display activated | X | X | dPY-Ab |
| **OFF** | 7-segment display deactivated | X | X | dPY-Ab |
| **UO** | Output voltage Uout (default value) | X | — | dPY-A |
| **US:** | Voltage setpoint Uset | X | — | dPY-A |
| **PS** | Power setpoint Pset | X | — | dPY-A |
| **IO** | Output current Iout (default value) | — | X | dPY-b |
| **IS** | Current setpoint Iset | — | X | dPY-b |
| **PO** | Output power Pout | — | X | dPY-b |
| **–** | Display switching time | — | — | ddc |

The ON or OFF status does not change the selected display function.

### Query Command

Syntax **`DISPLAY?`**
Sample response string: **`DISPLAY UO,IS`**

## ERROR? – List of Error Messages
☞ Menu

### Function

The three last different error messages can be read out with this command. The content of the µC-RSTSRC registers is added as the fourth parameter

The error list can be reset with the **`*CLS`** command.

A description of the errors is included in the section entitled "System Messages".

### Query Command

Syntax **`ERROR?`**

Sample response string: **`ERROR 031,098,000,001`**
**`ERROR n1,n2,n3,n4`**

Explanation of the example:

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| n1 | 031 | Command error, CME (last error) |
| n2 | 098 | Max. limit overflow (next to last error) |
| n3 | 000 | No further errors |
| n4 | 001 | The content of internal register µC-RSTSRC is added as additional information, although bits D7 through D5 are irrelevant. The value is not influenced by the "*CLS" command. |

## FSET, FSET? – Sequence Function Parameter
☞ Menu

### Function

In addition to USET, ISET and TSET, FSET is the fourth parameter for defining the sequence memory.

It determines which function will be executed upon transition to this memory location.

Execution of the parameter is only possible during the course of a running sequence (similar to the TSET parameter).

When the FSET parameter is transmitted, the current FSET setting is determined and is saved to the respective specification by means of the SM_STORE command.

The parameters for the FSET command are also part of the STORE command.

### Setting Command

Syntax: **`FSET txt`**
Default setting
or after RESET (*RST): CLR

### Query Command

Syntax: **`FSET?`**
Sample response string: **`FSET NF`**

*The parameters list can be found in the following column at the top of this page.*

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | CLR | Empty memory location, is ignored/skipped during execution.<br>CLR in the data record of the stop address of a sequence switches the output off after the sequence has been completed. |
| | NF | Sequence values USET, ISET and TSET without additional function (switching function) |
| | RU | Voltage ramp, duration TSET or TDEF |
| | RI | Current ramp, duration TSET or TDEF |
| | SOFF | Additionally switches SSET to OFF |
| | S_ON | Additionally switches SSET to ON |
| | AUOF | Additionally switches analog input UEXT to OFF |
| | AUON | Additionally switches analog input UEXT to ON |
| | AUSS | Additionally switches analog input UEXT to SSET control |
| | AIOF | Additionally switches analog input IEXT to OFF |
| | AION | Additionally switches analog input IEXT to ON |
| | AISS | Additionally switches analog input IEXT to SSET control |
| | Rxx | Sequence chain; USET/ISET/TSET are ignored *;<br>new device setup is loaded from setup memory xx (see **`*RCL n`** command)<br>! Thus all settings and parameters saved to Rxx apply.<br>Additional chains are also possible, but without automatic return upon reaching the stop address;<br>Value range: R01 … R12/15<br>**Note:** If a PSET function is active in the accessed SETUP setting, the SEQUENCE function is aborted. |
| | Sxx | Invoke subsequence; USET/ISET/TSET setting is ignored *;<br>! **Only** the START_STOP, REPETITION and TDEF parameters from setup memory xx are used.<br>Automatic return to the main sequence when the stop address of the subsequence is reached after the specified number of repetitions has been completed.<br>No return occurs if continuous running has been selected for the subsequence.<br>Maximum nesting depth: 1, value range: S01 … S12/15 |

* **Exception:** If the memory address is also the sequence stop address, the parameter values for USET and ISET are used as setting values when the program has finished running or has been canceled.

## GTL – GO TO LOCAL function (as of firmware version 005)
☞ ESC/LOCAL in "remote" state

### Function

The "GTL" command returns control of the device to front panel operation, similar to pressing the [LOCAL] key.

The command should not be strung together with a query command for serial interfaces (RS 232 or USB), because in this case – when the query data is read out – the remote state is restored.

Processing of this command takes place, for example, for all computer interfaces as a device message.

### Setting Command

Syntax: **`GTL`**

## IFC – Resetting the IEC Bus Interface (interface clear)
☞ —

### Function

The IEC bus interface at the device is reinitialized with the IFC (INTERFACE CLEAR) bus interface command, and is returned to the standard default settings.

| | |
|---|---|
| Addressing status | not addressed |
| Input and output buffers | unchanged |
| Service request SRQ | unchanged |
| Status byte register STB | unchanged |
| Event registers ESR, ERA, ERB, ERC | unchanged |
| Enable registers ESE, ERAE, ERBE, ERCE, SRE, PRE | unchanged |
| Set and stored parameters | unchanged |

### Setting Command

Syntax: **`IFC`**

## IL_H, IL_H? – Upper Limit Value for Current Setting
Menu

### Function

IL_H defines the upper setting limit (soft-limit) for current setpoint value Iset.

The limit can be used to assure that output current is not inadvertently set above a specified value.

The IL_H command corresponds to the ILIM command for the SSP6XN Konstanter series as an upper limit value.

Thus **`IL_H`** can also be replaced with **`ILIM`**.

When the **`ILIM?`** query is executed, **`IL_H +XXX.XXX`** is returned in response.

Values outside of the value range (Iset ≤ w ≤ Inom) are not accepted – they cause generation of an error message and setting of an error bit in event register ERC.2.

Inom is device-specific maximum nominal current.

Entered numeric values are rounded off to the device-specific resolution.

### Setting Command

Syntax: **`IL_H w`**
Value range: Iset ≤ w ≤ Inom
Default setting
or after RESET (*RST): w = Inom

### Query Command

Syntax: **`IL_H`**?
Sample response string: **`IL_H +XXX.XXX`**

### Comments

The IL_H function is not active for setting output current by means of control signal Iext via the analog interface.

## IL_L, IL_L? – Lower Limit Value for Current Setting
Menu

### Function

IL_L defines the lower setting limit (soft-limit) for current setpoint value Iset.

The limit can be used to assure that output current is not inadvertently set below a specified value.

Values outside of the value range (0 ≤ w ≤ Iset) are not accepted – they cause generation of an error message and setting of an error bit in event register ERC.2.

Inom is device-specific maximum nominal current.

Entered numeric values are rounded off to the device-specific resolution.

### Setting Command

Syntax: **`IL_L w`**
Value range: 0 ≤ w ≤ Iset
Default setting
or after RESET (*RST): w = 0

### Query Command

Syntax: **`IL_L`**?
Sample response string: **`IL_L +XXX.XXX`**

### Comments

The IL_L function is not active for setting output current by means of control signal Iext via the analog interface.

## IMAX? – Maximum Measured Current Value
Menu

### Function

The IMAX function reads out the highest output current value which was measured by the Iout measuring function and saved to Min-Max memory while the MINMAX function was set to ON.

If the measured current value has exceeded the measuring range limit at least once with the MINMAX function set to ON, “+OL” appears at the display for IMAX and “+999999.” is entered to the data string.

The Min-Max memory value can be reset to the momentarily measured value with **`MINMAX RST`** (for all 4 parameters at once).

### Query Command

Syntax: **`IMAX`**?
Sample response string: **`IMAX +XXX.XXX`**

## IMIN? – Minimum Measured Current Value
Menu

### Function

The IMIN function reads out the lowest output current value which was measured by the IOUT measuring function and saved to Min-Max memory while the MINMAX function was set to ON.

If the measured current value has fallen below the measuring range limit at least once with the MINMAX function set to ON, “–OL” appears at the display for IMIN and “–999999.” is entered to the data string. The Min-Max memory value can be reset to the momentarily measured value with MINMAX RST (for all 4 parameters at once).

### Query Command

Syntax: **`IMIN`**?
Sample response string: **`IMIN +XXX.XXX`**

## IOUT? – Querying the Momentary Current Value
SELECT B

### Function

The IOUT? function reads out the momentary measured value for output current.

| Type | Current Measuring Range | | Resolution |
|---|---|---|---|
| Nominal Current | Min. [A] | Max. [A] | |
| 60 A | -032,766 | +098,300 A | 2 mA |
| 120 A | -065,532 | +196,600 A | 4 mA |
| 180 A | -098,298 | +294,900 A | 6 mA |

The upper range values may change minimally after balancing!

If the measuring range is exceeded or fallen short of,
“+/–OL” is displayed or “+/–999999” is entered to the data string.

### Query Command

Syntax: **`IOUT`**?
Sample response string: **`IOUT +XXX.XXX`**

## ISET, ISET? – Current Setpoint
### SELECT B or rotary encoder Iset

**Function**

The output current setpoint is set with ISET. ISET? returns the momentarily selected current setpoint as a response.

Values outside of the value range (0 ≤ IL_L ≤ **w** ≤ IL_H ≤ Inom) are not accepted – they and cause generation of an error message and setting of an error bit in event register ERC.2.

Entered numeric values are rounded off to the device-specific resolution.

**Setting Command**

Syntax: **ISET w**
Value range: 0 ≤ IL_L ≤ **w** ≤ IL_H ≤ Inom
Default setting
or after RESET (*RST): w = 0

**Query Command**

Syntax: **ISET**?
Sample response string: **ISET +XXX.XXX**

| Device Type | Setting Range | | Setting Resolution | |
|---|---|---|---|---|
| Nom. Current [A] | Min. [A] | Max. [A] | Remote [A] | Manual [A] |
| 60 | 0,000 | 60,000 | 0,001 | 0,001 |
| 120 | 0,000 | 120,000 | 0,002 | 0,002/0,010 |
| 180 | 0,000 | 180.00 | 0.003125 | 0.003125/0.0125 |

## MEASURE, MEASURE? – Measuring Function (currently not implemented)
### Menu

## MEAS_LPF, MEAS_LPF? – Low-Pass Filter for Measured Value Acquisition
### Menu

**Function**

Selection can be made from amongst four time constants for evaluation of the measuring signal. This selection applies equally to the measured quantities for both voltage and current.

**Setting Command**

Syntax: **MEAS_LPF n**
Value range: n = 1, 2, 3, 4
Default setting
or after RESET (*RST): n = 3

**Query Command**

Syntax: **MEAS_LPF**?
Sample response string: **MEAS_LPF n**

**Parameters List**

| Parameter | Content | Meaning Time Constant |
|---|---|---|
| n | 1 | 1 ms |
| | 2 | 10 ms |
| | 3 | 50 ms |
| | 4 | 400 ms |

## MINMAX, MINMAX? – Min-Max Storage for Measured U and I Values
### Menu

**Function**

The MINMAX function makes it possible to save minimum and maximum measured voltage and current values to memory. The saved values, UMIN, UMAX, IMIN and IMAX, can then be displayed or queried via the interfaces.

The "MINMAX ON" setting is also a prerequisite for the "tolerance band function"
(setting command `UI_C_SET w1,w2,w3,w4` for the reference values).

**Setting Command**

Syntax: **MINMAX txt**
Parameter txt: OFF/ON/RST
Default setting
or after RESET (*RST): **OFF**

**Query Command**

Syntax: **MINMAX?**
Sample response string: **MINMAX OFF**

**Parameters List**

| txt | Description |
|---|---|
| **OFF** | Storage of Min-Max values deactivated<br>Stored values remain unchanged |
| **ON** | Storage of Min-Max values activated<br>Enable tolerance band function for CRB.0/1, ERC.0/1.<br>If the SIG outputs are correspondingly configured, a switching signal can be generated at the analog interface. |
| **RST** | Contents of Min-Max memory are reset, i.e. are replaced with the momentary measured value for the corresponding parameter:<br>Umin = Uout<br>Umax = Uout<br>Imin = Iout<br>Imax = Iout |

## MODE? – Momentary Control Mode of the Power Output
### LED

**Function**

The device responds with the momentary operating mode (control mode) in reply to the MODE? query command.

**Query Command**

Syntax: **MODE?**
Sample response string: **MODE CV**

**Parameters List**

| Parameter | Content | Meaning | LED |
|---|---|---|---|
| txt | **OFF** | Output deactivated | — |
| | **CV** | Constant voltage regulating mode | CV + OUTPUT |
| | **CC** | Constant current regulating mode | CC + OUTPUT |
| | **CP** | Constant power regulating mode overload (power limiting) | PLim + OUTPUT |

## OCP, OCP? – Overcurrent Protection
## ☝ Menu, LED

### Function

The OCP function (**o**ver **c**urrent **p**rotection) determines how the power output will respond if load current climbs to the selected OCSET value.

The OCP function is used in addition to current regulation, whose setpoint is specified with ISET or via the analog control input.

The OCP function protects connected power consumers against continuous overcurrent, although a higher current value is required intermittently. The function also makes it possible to activate another device configuration in a case of this sort.

Load current is compared with the OCSET value generated with an integrated D-A converter by means of an autonomous comparator, and is evaluated.

The ensuing reaction is shown in the following table.

Activation of the OCP function is indicated at the front panel by means of the “OCP ON” LED. If OCP shuts down, this is additionally indicated by the “OCP” LED.

### Setting Command

Syntax: **`OCP txt`**
Parameter txt: OFF/ON/R01 … R12/15
Default setting
or after RESET (*RST): OFF

### Query Command

Syntax: **`OCP?`**
Sample response string: **`OCP OFF`**

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | **OFF** | OCP function inactive |
| | **ON** | OCP function activated: The output is shut down if output current is equal to or exceeds the specified OC_SET limit value for a duration of OC_DELAY. |
| | **Rxx** | Instead of a shutdown, recall of a device configuration from setup memories 01 through 12/15 can be activated with R01 … R12/15. |

## OCSET, OCSET? – Overcurrent Protection Trigger Value
## ☝ SELECT B, menu

### Function

The triggering threshold reference value required for the OCP function is set with OCSET.

### Setting Command

Syntax: **`OCSET w`**
Value range: OCSETmin ≤ w ≤ OCSETmax
Default setting
or after RESET (*RST): OCSETmax

| Device Type | Setting Range | | Setting Resolution | |
|---|---|---|---|---|
| Nom. Current [A] | OCSETmin. [A] | OCSETmax. [A] | Remote [A] | Manual ☝ [A] |
| 60 | 03:00 | 80.00 | 0.02 | 0.02 |
| 120 | 06:00 | 160.00 | 0.05 | 0.05 |
| 180 | 09:00 | 240.0 | 0.1 | 0.1 |

### Query Command

Syntax: **`OCSET?`**
Sample response string: **`OCSET +080.000`**

## OC_DELAY, OC_DELAY? – Overcurrent Protection Trigger Delay
## ☝ Menu

### Function

Desired response delay for the OCP function is set with OC_DELAY. Delay time is specified in seconds.

If output current drops to below the OCSET value before OC_DELAY expires, the shutdown sequence is interrupted and restarted the next time the threshold is exceeded.

### Setting Command

Syntax: **`OC_DELAY w`**
Value range: 0 ≤ w ≤ 65,535
Default setting
or after RESET (*RST): 0

### Query Command

Syntax: **`OC_DELAY?`**
Sample response string: **`OC_DELAY XX.XXX`**

## OUTPUT, OUTPUT? – Switching the Power Output On and Off
## OUTPUT / LED

### Function

The power output can be activated and deactivated with the OUTPUT function.

**Activation procedure:** OUTPUT ON:

Current and voltage values of “0” are specified initially for a period of approximately 2 ms with activated output for the transition from the “highly resistive” condition. The output is then set to the selected voltage and current setpoints.

**Deactivation procedure:** OUTPUT OFF:

The power output is deactivated and rendered highly resistive with the OUTPUT OFF command. In doing so, differentiation must be made as to whether the internal dynamic sink is on or off (setting command: SINK on / SINK OFF).

However, the output terminals are not electrically enabled.

### OUTPUT OFF with SINK ON

The setpoints for voltage and current are set to 0 V and 0 A. The sink is activated for approximately 300 ms. The sink discharges the output capacitors as far as possible. The sink is then switched off and the output becomes highly resistive as a result.

### OUTPUT OFF with SINK OFF

The setpoints for voltage and current are set to 0 V and 0 A. The power output is deactivated and becomes highly resistive as a result.

The output capacitors are discharged via the connected load only. Output voltage is correspondingly reduced.

### Setting Command

Syntax: **OUTPUT txt**
Parameter txt: OFF/ON
Default setting
or after RESET (*RST): OFF

### Query Command

Syntax: **OUTPUT?**
Sample response string: **OUTPUT ON**

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | **OFF** | Output is switched off,<br>OUTPUT LED off, control mode LEDs are off |
| | **ON** | Output is switched on,<br>OUTPUT LED lights up, control mode LED lights up |

### Comments

If the output is switched off by a trigger signal in the “T_MODE OUT” operating mode, i.e. in the off state, the signal has higher priority.

An OUTPUT ON command is not executed, and bit 4 is set in event register B (OUTE).

“Err 073” also appears briefly at the display as a warning in the event of manual operation.

Additional functions which may influence the status of the output include:

– OTP, overtemperature protection
– OVP, overvoltage protection
– OCP with activated “OCP ON” parameter
– SEQUENCE function
– T_MODE function
– POWER_ON
– *RCL

## OVP, OVP? – Overvoltage Protection
## Menu, LEDs

### Edit Formulation Function

The OVP function (**o**ver**v**oltage **p**rotection) specifies how the power output will respond if output voltage is equal to or exceeds the selected OVSET value.

The OVP function is an overriding protective function and is independent of the voltage and current regulators.

The OVP function protects connected power consumers against continuous overvoltage, although higher voltage is required intermittently. The function also makes it possible to activate another device configuration in a case of this sort.

Output voltage is compared with the OVSET value from the OVP-DAC by an autonomous comparator.

The ensuing reaction is shown in the following table, and execution can be delayed by means of OV_DELAY.

Where OV_DELAY = 0, the power output is switched off directly by the OVP comparator.

Activation of the OVP function is indicated at the front panel by means of the “OVP ON” LED.

If OVP shuts down, this is additionally indicated by the “OVP” LED.

### Setting Command

Syntax: **OVP txt**
Parameter txt: OFF/ON/R01 … R12/15
Default setting
or after RESET (*RST): ON

### Query Command

Syntax: **OVP?**
Sample response string: **OVP OFF**

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | **OFF** | OVP function inactive: |
| | **ON** | OVP function activated:<br>The output is shut down if output voltage is equal to or exceeds the specified OV_SET limit value for a duration of OV_DELAY. |
| | **Rxx** | Instead of a shutdown, recall of a device configuration from setup memories 01 through 12/15 can be activated with R01 … R12/15. |

## OV_DELAY, OV_DELAY? – Overvoltage Protection Triggering Delay
## Menu

### Function

Desired response delay for the OVP function is set with OV_DELAY. Delay time is specified in seconds.

If output voltage drops to below the OVSET value before OV_DELAY expires, the shutdown sequence is interrupted and restarted the next time the threshold is exceeded.

Where OV_DELAY = 0, the OVP comparator switches the power output off directly as well.

### Setting Command

Syntax: **OV_DELAY w**
Value range: $0 \le w \le 65{,}535$
Default setting
or after RESET (*RST): 0

### Query Command

Syntax: **OV_DELAY?**
Sample response string: **OV_DELAY XX.XXX**

## OVSET, OVSET? – Overvoltage Protection Trigger Value
☞ SELECT A and menu

### Function

The triggering threshold reference value required for the OVP function is set with OVSET.

### Setting Command

| | |
|---|---|
| Syntax: | **OVSET w** |
| Value range: | OVSETmin ≤ w ≤ OVSETmax |
| Default setting or after RESET (*RST): | OVSETmax |

### Query Command

Syntax: **OVSET?**
Sample response string: **OVSET +080.000**

### Parameters List

| Parameter | For Device Type | Setting Range | | Setting Resolution | |
|---|---|---|---|---|---|
| | Nom. Voltage [V] | OVSETmin. [V] | OVSETmax. [V] | Remote [V] | Manual ☞ [V] |
| w | 60 | 03:00 | 80.00 | 0.02 | 0.02 |

### Comments

Amongst other causes, overvoltage protection can be triggered by:

- USET ≥ OVSET (due to manual setting, programming command, memory recall, sequence run or Uset control signal to the analog interface)
- Sensing leads with reversed polarity
- Interrupted output lead during sensing mode operation
- Interference from the consumer
- Parallel connected voltage sources
- Dynamic output voltage overshooting
- Device malfunction or defect

## POUT? – Querying Momentary Output Power
☞ SELECT B and menu

### Function

The POUT? function reads out momentary output power as the product of output voltage and output current.

### Query Command

Syntax: **POUT?**
Sample response string: **POUT +XXXXX.X**

**Measuring range:** Due to the fact that the UOUT and IOUT measuring functions are utilized, the respective measuring ranges apply for power measurements as well. If one or both of the measured quantities UOUT and IOUT violate their respective measuring ranges, the product of POUT (UOUT x IOUT) is displayed as "–OL" or "OL", or "+/–999999" is entered to the data string.

## POWER_ON, POWER_ON? – Response After Power On
☞ Menu

### Function

The POWER_ON function determines the status of device settings after mains power has been switched on.

### Setting Command

| | |
|---|---|
| Syntax: | **POWER_ON txt** |
| Parameter txt: | RST/SBY/RCL/R01 … R12/15 |
| Default setting or after RESET (*RST): | RST |

### Query Command

Syntax: **POWER_ON?**
Sample response string: **POWER_ON RST**

### Parameters List

| Parameter | Content | Meaning |
|---|---|---|
| txt | **RST** | RESET: Defined default settings are utilized. → Default setting |
| | **SBY** | STANDBY: Same device settings as before shutdown, but the power output remains inactive (OUTPUT OFF) |
| | **RCL** | RECALL: Same device settings as before shutdown – power output remains in previous state |
| | **Rxx** | Recall a device configuration saved to setup memory under XX |

## PSET, PSET?
☞ SELECT A

### Function

The PSET function[1] is activated by setting a PSET parameter value < Pnom.

The PSET operating mode is indicated by the active, green "CP LED"[1] and the "MODE? query results in the "MODE CP" response.
(Status and event register queries "CRA?" and "ERA?" respond with the power section's control state and should be interpreted accordingly.)

With the help of the measurement functions, settings for voltage and current are calculated temporarily for the specified load and read out to the D-A converters. The "digital control range" is limited by the USET and ISET settings. If setpoint PSET for the connected load cannot be reached, this is also indicated by the "CV" or "CC" LED.

**!** **Attention!**
Activation of PSET automatically shuts down analog control inputs Uext and Iext, i.e. the "ANALOG_IN OFF, OFF" command is executed automatically. The PSET function cannot be combined with the SEQUENCE function!

### Setting Command

| | |
|---|---|
| Syntax: | **PSET w** |
| Value range: | 0 ≤ w ≤ Pnom<br>w = Pnom (no power control) |
| Default setting or after RESET (*RST): | w = Pnom [2] |

### Query Command

Syntax: **PSET?**
**PSET +XXXXX.X**
Sample response string: **PSET +01499.9**

[1] "Power control", available as of version 004
[2] After "*RST", the device's maximum possible output power can be ascertained with the PSET? query command. Depending upon whether the device is operated with 115 or 230 V AC, the response is either Pnom/2 or Pnom.

## REPETITION, REPETITON? – Number of Repetitions for SEQUENCE Function

Menu

### Function

The REPETITION parameter determines how many times a sequence will be repeated, which is defined by the current START and STOP addresses.

i is an optional parameter which addresses the setup memory (1 to 12/15), to which the repetition value will be written, and from which it will be read.

### Setting Command

Syntax: **`REPETITION n(,i)`**
Value range: 0 ≤ n ≤ 255
Default setting
or after RESET (*RST): 0

### Query Command

Syntax: **`REPETITION? (i)`**
Sample response string: **`REPETITION n`**

### Parameters List

| Param-eter | Content | Meaning |
|---|---|---|
| n | 0 | Continuous repetition |
| | 1 to 255 | Number of sequence repetitions |

## RLOAD? – Load Resistance

Menu

### Function

The RLOAD function reads out the value of momentary load resistance as the quotient of output voltage and output current.

### Query Command

Syntax: **`RLOAD?`**
Sample response string: **`RLOAD +XXX.XXX`**

Measuring range: Due to the fact that the UOUT and IOUT measuring functions are utilized, the respective measuring ranges apply for power measurements as well.
If the output is inactive (OUTPUT OFF), if one (or both) measured quantities UOUT or IOUT exceed(s) the measuring range limits, or if the calculated value in numeric format “XXX.XXX” cannot be displayed, the quotient RLOAD = UOUT / IOUT is indicated at the display as “OL” or entered to the data string as “999999.”

## SEQUENCE, SEQUENCE? – Automatic Sequential Recall of Stored Setting Values, Sequence Status Query

Menu

### Function

The sequence function makes it possible to generate voltage and current profiles over a period of time, for example in order to create test signals.

The required setting values and parameters are saved to the appropriate memory to this end.

Values are saved with the commands **`SM_STORE ADR`** or **`STORE ADR,USET,ISET,TSET,FSET.`** 1536/1700 memory locations are available for this function. If dwell time is set to TSET = 0, an overriding TDEF becomes effective.

The following control commands determine the course of the sequence. The sequence is defined by means of START and STOP addresses (**`START_STOP xxxx,xxxx`**), and the number of repetitions (**`REPETITION n`**).

**Note:** With appropriate configuration, sequence control (GO/STOP or START/STEP) is also possible via the trigger inputs (analog interface).
The SEQUENCE function cannot be combined with the PSET function!

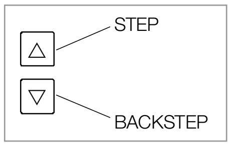
### Setting command (sequence control command)

Syntax: **`SEQUENCE txt`**

### Control parameters list

If an addressed memory location is empty (no executable content), the sequence jumps to the next higher executable memory location.

| Param-eter | Content | Meaning |
|---|---|---|
| txt | **OFF** | Jump to stop address and end the sequence run or step-by-step control; same as stop. If there is no content (CLR), the power output is switched (OUTPUT OFF). |
| | **GO** | Start sequence run as of start address |
| | **HOLD** | Pause, suspend sequence at current memory location |
| | **CONT** [2] | Resume automatic sequence run with next executable memory location |
| | **STRT** [1] | Jump to start address and execute its content. Power output is switched on, step-by-step control is possible. |
| | **STEP** [1, 2] | Execute the next valid memory location. In the case of step-by-step control, the “REPETITION” parameter is ignored, i.e. a subsequence, for example, is executed only once. |
| | **BSTP** [1] | The “repetition” parameter is ignored, subsequences are skipped, ramp functions are executed just like “NF”. |
| | **STOP** [1] | Jump to stop address and end the automatic sequence run or step-by-step control. If there is no content (CLR), the power output is switched (OUTPUT OFF). |
| | **ESC** | Sequence is ended using the momentary setting without jumping to the final value. |




1 **Step-by-step control (remote/manual)**
If the T_MODE parameter is set to “RCL”, the step pulse can be specified by means of an external signal applied to the appropriate trigger input at the analog interface.

2 A memory address can be specified as an additional, optional parameter for these commands, as of which sequence execution is started or resumed.
Example:
**`SEQUENCE CONT,n`** where start address ≤ n ≤ stop address

### Query Command (sequence status)

Syntax: **`SEQUENCE?`**
Sample response string: **`SEQUENCE txt,n1,n2,n3`**

### Query parameters list

| Param-eter | Content | Meaning – sequence status |
|---|---|---|
| txt | **RDY** | Device in initial state, sequence run completed |
| | **HOLD** | Sequence run paused |
| | **RUN** | Sequence run is active |
| n1 | 000<br>001 … 012/015 | The run is part of the main sequence<br>The run is part of a subsequence; defined in the specified setup memory location (1 to 12/15) |
| n2 | 001 to 255<br>999 | Remaining number of repetitions,<br>continuous repetition |
| n3 | 0001 … 1536/1700 | Momentarily executed memory location |

## SIG123, SIG123? – Analog Interface Signal Outputs
Menu

### Function

**Two** floating signal outputs (SIG 1 and SIG 2) and one signal output with reference to AGND 2 (SIG 3) are provided at the analog interface. They can be used to trigger control functions in the application.

Different device functions and statuses can be assigned to these signals.

### Setting Command

Syntax: **`SIG123 txt1,txt2,txt3`**
Default setting
or after RESET (*RST): OFF

### Query Command

Syntax: **`SIG123?`**
Sample response string: **`SIG123 txt1,txt2,txt3`**

### Parameters List

| Parameter | Content | Meaning – Assignment | Level |
|---|---|---|---|
| txt n | OFF | SIG n: direct off | passive high |
| | ON | SIG n: direct on | active low |
| | OUT | OUTPUT ON<br>OUTPUT OFF | Passive high<br>Active low |
| | MODE | OFF or CV<br>CC or OL | Passive high<br>Active low |
| | SEQ | READY/STOP<br>RUN | Passive high<br>Active low |
| | SSET | OFF<br>ON | Passive high<br>Active low |
| | U_LO [1] | $U_{meas} \geq w1$<br>$U_{meas} < w1$ | Passive high<br>Active low |
| | U_HI [1] | $U_{meas} \leq w2$<br>$U_{meas} > w2$ | Passive high<br>Active low |
| | I_LO [1] | $I_{meas} \geq w3$<br>$I_{meas} < w3$ | Passive high<br>Active low |
| | I_HI [1] | $I_{meas} \leq w4$<br>$I_{meas} > w4$ | Passive high<br>Active low |

[1] The signal outputs can be logically linked using the comparison function. The reference values are defined by parameters **w1, w2, w3** and **w4** from the UI_C_SET command. Momentary measured voltage and current values are compared with these parameters and evaluated.

| Parameter | Meaning in UI_C_SET Command |
|---|---|
| w1 | Lower voltage reference value |
| w2 | Upper voltage reference value |
| w3 | Lower current reference value |
| w4 | Upper current reference value |

## SINK, SINK? – Sink Function On/Off
Menu

### Function

The device is equipped with a sink function for improved dynamic characteristics, which can be activated ort deactivated as desired. After an OUTPUT OFF command, the sink is deactivated (if initially activated) after a specified period of time (300 ms).

### Setting Command

Syntax: **`SINK txt`**
Parameter txt: OFF/ON
Default setting
or after RESET (*RST): ON

### Query Command

Syntax: **`SINK?`**
Sample response string: **`SINK txt`**

## SM_LOAD – Load from Sequence Memory Location
Menu

### Function

The content of a memory location can be loaded in a targeted fashion with the SM_LOAD command. The USET, ISET, TSET and FSET parameters are entered to the current device settings during this procedure. USET and ISET are read out at the power output in the case of OUTPUT ON.

### Setting Command

Syntax: **`SM_LOAD n`**
Value range: 1 ≤ n ≤ 1536/1700

## SM_STORE – Store to Sequence Memory Location
Menu

### Function

The contents of the USET, ISET, TSET and FSET parameters from the current device settings can be written to the specified memory location with the SM_STORE command.

The range of memory locations between the start and stop addresses can be cleared with the **`SM_STORE 0`** command.

These memory locations are then in the empty state (CLR).

### Setting Command

Syntax: **`SM_STORE n`**
Value range: 1 ≤ n ≤ 1536/1700
Special case n = 0 (delete range)

## SSET, SSET? – Command for an Assigned Switching Function (signal level switching function)
Menu, SSET key

### Function

The SSET switching status can be controlled with the SSET setting command or with the corresponding FSET parameter (S_ON/SOFF) of the sequence function. The SSET switching function can then be linked with analog interface functions for switching signal outputs SIGx (command: SIG123) and/or for controlling the analog inputs Uext and Iext, (command: ANALOG_IN).

### Setting Command

Syntax: **`SSET txt`**
Parameter txt: OFF/ON
Default setting
or after RESET (*RST): OFF

### Query Command

Syntax: **`SSET?`**
Sample response string: **`SSET txt`**

## START_STOP, START_STOP? – Start and Stop Memory Address for the SEQUENCE Function
Menu

### Function

The start and stop addresses of the sequence to be executed are defined with the START_STOP command. The STOP address must be equal to or greater than the START address.

i is an optional parameter which addresses the setup memory (1 to 12/15), to which the START-STOP values will be written, and from will they will be read.

### Setting Command

Syntax: **`START_STOP n1,n2(,i)`**
Value range: 1 ≤ n1 ≤ n2 ≤ 1536/1700
Default setting
or after RESET (*RST): 1.1

### Query Command

Syntax: **`START_STOP? (i)`**
Sample response string: **`START_STOP n1,n2`**

## STORE, STORE? – Transfer Parameters Directly to Memory
(menu – in sequential order of entry)

### Function

This command is used to write the USET, ISET, TSET and FSET parameters directly to a memory location in order to set up a sequence. The parameters must be entered one after the other via the edit menu.

### Setting Command

Syntax: **`STORE n,w1,w2,w3,txt`**

### Parameters List

| Param-eter | Content | Formats / Meaning |
|---|---|---|
| *n* | **1** to **1536/1700** | Memory address |
| *w1* | 0 ≤ w1 ≤ Unom | +nnn.nnn [V] voltage setpoint USET |
| w2 | 0 ≤ w2 ≤ Inom | +nnn.nnn [A] current setpoint ISET |
| w3 | 0<br>0 [s] < w3 ≤ 65,535 [s] | w3 = 0: TSET executes TDEF<br>nn.nnn [s] dwell time TSET |
| txt | Content from table for FSET | FSET function<br>This parameter is identical to the setting options for the FSET command. |

### Query Command

Syntax: **`STORE?`**
Syntax: **`STORE? n`**
Syntax: **`STORE? n1,n2`**
Syntax: **`STORE? n1,n2,tab`**

The response includes the entire parameter set for each memory location: **`STORE n,w1,w2,w3,txt`**

### Parameters List

Depending upon which query command is selected, one of the following responses is be generated:

| Command | Value range | Meaning – Response |
|---|---|---|
| **Sto**re? | | Query contents of a memory range from the start address to the stop address of the current sequence |
| **Sto**re? n | n = 1 through 1536/1700 | Query content of memory location n |
| **Sto**re? n1,n2 | n1, n2 = 1 to 1536/1700 n2 ≥ n1 | Query contents of a memory range from address n1 to address n2 |
| **Sto**re? n1,n2,tab | n1, n2 = 1 to 1536/1700<br>n2 ≥ n1 | Query contents of a memory range from address n1 to address n2,<br>delimiter between output parameters:<br>tabulator character (hex code: 09h)<br>Decimal delimiter = decimal comma (hex code: 2Ch)<br>Line break (hex code: 0Ah) |

## TDEF, TDEF? – Default Time for SEQUENCE Function
Menu

### Function

The TDEF parameter setting defines the dwell time default setting for a voltage-current value pair to be recalled.
TDEF is used instead of TSET if TSET has not been set to any specific value, but rather to 0 [s].

**Note:** Use of TDEF is advantageous if one or several identical dwell times occur within a given sequence whose values need to be changed frequently.

i is an optional parameter which addresses the setup memory (1 to 12/15), to which the TDEF value will be written, and from which it will be read.

### Setting Command

Syntax: **`TDEF w(,i)`**
Value range: 0.001 ≤ w ≤ 65,535 [s]
Default setting
or after RESET (*RST): 0,001

### Query Command

Syntax: **`TDEF? (i)`**
Sample response string: **`TDEF w`**

## TIMEDATE, TIMEDATE? – Programmable System Clock (RTC)
Menu

### Function

System date and time in accordance with ISO 8601 can be entered to the device with this command. The date entered here is used for device balancing (ADJUST command).

### Setting Command

Syntax: **`TIMEDATE yyyy-mm-ddThh:mm:ss`**
Default setting
or after RESET (*RST): remains unchanged

### Query Command

Syntax: **`TIMEDATE?`**
Sample response string: **`TIMEDATE yyyy-mm-ddThh:mm:ss`**
**`TIMEDATE 2007-10-01T08:00:05`**

The specified format must be adhered to:
yyyy: <year (2000 …)
– Delimiter (“–”)
mm: month (01 … 12)
– Delimiter (“–”)
dd: day (01 … 31)
T: delimiter (“T”)
hh:mm:ss hours:minutes:seconds

## T_MODE, T_MODE? – Function Selection for the Trigger Inputs
Menu

### Function

Two floating trigger inputs are provided at the analog interface whose action can be defined independent of each other. In this way, control functions can be triggered in the device from the application.

Depending upon which function is selected, the trigger input is level or edge controlled.

**Note:** Detailed descriptions of the control level are included in chap. 7, “Analog Interface”.

### Setting Command

Syntax: **T MODE txt1,txt2**
Default setting
or after RESET (*RST): OFF

### Query Command

Syntax: **T MODE?**
Sample response string: **T MODE txt1,txt2**

### Parameters List

| Param-eter | Content | Meaning | Level-Con-trolled | LED [1] |
|---|---|---|---|---|
| txt n | **OFF** | Trigger input function deactivated | X | |
| | **OUT** | Trigger input acts upon the OUTPUT: Output on/off | X | OUTPUT |
| | **SQS** | RECALL: memory recall (single step), edge controlled, time dependent (functions like SEQUENCE STEP) | | SEQ STS |
| | **SEQ** | SEQUENCE: sequential memory recall (functions like SEQUENCE GO) | X | SEQ STS |
| | **LLO** | LOCAL LOCKED: control panel disabling | X | LCL LOCKED |
| | **MIN** | MINMAX: Min-Max memory for measured values | X | |
| | **AIX** | Analog input UEXT, IEXT | X | Uext ON |
| | **AIU** | Analog input UEXT | X | Uext ON |
| | **AII** | Analog input IEXT | X | Iext ON |

1 The associated TRGx LED lights up along with the selected trigger input if the trigger parameter is not set to OFF and the trigger input is active.

## TSET, TSET? – Memory Location-Specific Dwell Time for the SEQUENCE Function
Menu

### Function

The TSET setting parameter defines memory location-specific dwell time for reading out a pair of voltage and current values for a sequence. If no specific value, but rather 0 [s] is assigned to TSET, TDEF is used as a default value for execution of the sequence function.

### Setting Command

Syntax: **TSET w**
Value range: 0.000 ≤ w ≤ 65,535 [s]
Default setting
or after RESET (*RST): 0,000

### Query Command

Syntax: **TSET?**
Sample response string: **TSET w**

### Comments

If dwell times of greater than 65,535 seconds are required, this can be achieved by specifying the same voltage and current values for several consecutive memory locations.

Another possibility is to invoke subsequences with the corresponding number of repetitions.

## UI_C_SET, UI_C_SET? – Reference Values for Uout/Iout Tolerance Band Function
Menu

**Attention!**
When restoring the default settings using the “Write to Device” function in the “Notes” tab of the soft front panel, parameters stored for the “UI_C_SET” function are overwritten by the parameters for the current configuration.

### Function

This function makes it possible to set up reference values for voltage and current, which are continuously compared with momentary measured values. In this way, for example, checking is possible in order to determine whether or not actual voltage and current values lie within the specified range (tolerance band function).

The results of this comparison can be queried in status register CRB?, bits 0 and 1, and in event register ERC?, bits 0 and 1. The results can also be assigned to signal outputs SIG123 at the analog interface with the help of the **SIG123 txt1,txt2,txt3** command.

### Setting Command

Syntax: **UI_C_SET w1,w2,w3,w4**
Range of values w1, w2:0 ≤ w1 < w2 ≤ Unom [V]
Range of values w3, w4:0 ≤ w3 < w4 ≤ Inom [A]
Default setting
or after RESET (*RST): 0,Unom,0,Inom

### Query Command

Syntax: **UI_C_SET?**
Sample response string: **UI_C_SET w1,w2,w3,w4**

### Parameters List

| Parameter | Format | Meaning |
|---|---|---|
| w1 | nnn.nnn [V] | Lower voltage reference value |
| w2 | nnn.nnn [V] | Upper voltage reference value |
| w3 | nnn.nnn [A] | Lower current reference value |
| w4 | nnn.nnn [A] | Upper current reference value |

## UL_H, UL_H? – Upper Limit Value for Voltage Setting
Menu

### Function

UL_H defines the upper setting limit (soft-limit) for voltage setpoint value Uset. The limit can be used to assure that output voltage is not inadvertently set above a specified value. The UL_H command corresponds to the ULIM command for the SSP6XN Konstanter series as an upper limit value.

Thus **UL_H** can also be replaced with **ULIM**.

When the **ULIM?** query is executed, **UL_H +XXX.XXX** is returned as a response.

Values outside of the value range (Uset ≤ w ≤ Unom) are not accepted – they cause generation of an error message and setting of an error bit in event register ERC.2. Unom is the device-specific maximum nominal voltage. Entered numeric values are rounded off to the device-specific resolution.

### Setting Command

Syntax: **UL_H w**
Value range: Uset ≤ w ≤ Unom
Default setting
or after RESET (*RST): w = Unom

### Query Command

Syntax: **UL_H?**
Sample response string: **UL_H +XXX.XXX**

### Comments

The UL_L function is not active for setting output current by means of control signal Iext via the analog interface.

## UL_L, UL_L? – Lower Limit Value for Voltage Setting
☞ Menu

### Function

UL_L defines the lower setting limit (soft-limit) for voltage setpoint value Uset.

The limit can be used to assure that output voltage is not inadvertently set below a specified value.

Values outside of the value range (0 ≤ w ≤ Uset) are not accepted – they cause generation of an error message and setting of an error bit in event register ERC.2.

Unom is the device-specific maximum nominal voltage.

Entered numeric values are rounded off to the device-specific resolution.

### Setting Command

Syntax: **UL_L w**
Value range: 0 ≤ w ≤ Uset
Default setting
or after RESET (*RST): w = 0

### Query Command

Syntax: **UL_L**?
Sample response string: **UL_L +XXX.XXX**

### Comments

The UL_L function is not active for setting output voltage by means of control signal Uext via the analog interface.

## UMAX? – Maximum Measured Voltage Value
☞ Menu

### Function

The UMAX function reads out the lowest output voltage value which was measured by the Uout measuring function and saved to Min-Max memory while the MINMAX function was set to ON.

If the measured voltage value has exceeded the measuring range limit at least once with the MINMAX function set to ON, "+OL" appears at the display for UMAX and "+999999." is entered to the data string.

The Min-Max memory value can be reset to the momentarily measured value with **MINMAX RST** (for all 4 parameters at once).

### Query Command

Syntax: **UMAX**?
Sample response string: **UMAX +XXX.XXX**

## UMIN? – Minimum Measured Voltage Value
☞ Menu

### Function

The UMIN function reads out the lowest output voltage value which was measured by the Uout measuring function and saved to Min-Max memory while the MINMAX function was set to ON.

If the measured voltage value has fallen below the measuring range limit at least once with the MINMAX function set to ON, "–OL" appears at the display for UMAX and "–999999." is entered to the data string.

The Min-Max memory value can be reset to the momentarily measured value with **MINMAX RST** (for all 4 parameters at once).

### Query Command

Syntax: **UMIN**?
Sample response string: **UMIN +XXX.XXX**

## UOUT? – Querying the Momentary Voltage Value
☞ SELECT A

### Function

The UOUT? function reads out the momentary measured value for output voltage.

| Type | Voltage Measuring Range | | Resolution |
|---|---|---|---|
| Nominal Voltage | Min. [V] | Max. [V] | |
| 60 W | -016,384 | +098,300 A | 2 mV |

The upper range values may change minimally after balancing!
If the measuring range is exceeded or fallen short of,
"+/–OL" is displayed or "+/–999999" is entered to the data string.

### Query Command

Syntax: **UOUT**?
Sample response string: **UOUT +XXX.XXX**

## USET, USET? – Voltage Setpoint Value
☞ SELECT A and rotary encoder Uset

### Function

The output voltage setpoint is set with USET. USET? returns the momentarily selected current setpoint as a response.

Values outside of the value range (0 ≤ UL_L ≤ **w** ≤ UL_H ≤ Unom) are not accepted – they cause generation of an error message and setting of an error bit in event register ERC.2.

Entered numeric values are rounded off to the device-specific resolution.

### Setting Command

Syntax: **USET *w***
Value range: 0 ≤ UL_L ≤ **w** ≤ UL_H ≤ Unom
Default setting
or after RESET (*RST): w = 0

### Query Command

Syntax: **USET**?
Sample response string: **USET +XXX.XXX**

| Device Type | Setting Range | | Setting Resolution | |
|---|---|---|---|---|
| Nom. Voltage [V] | Min. [V] | Max. [V] | Remote [V] | Manual [V] |
| 60 | 0,000 | 60,000 | 0,001 | 0,001 |

## WAIT – Additional Waiting Time
☞ —

### Function

Command for specifying an additional waiting time between execution of two commands. This function can be used to add additional waiting time within a data string (linked commands) during processing/execution.

For example, this allows for defined programming of a specified power-on status within a command string with execution time in the ms range.

### Setting Command

Syntax: **WAIT *w***
Value range: 0,001 s ≤ w ≤ 65,535 s

### Note

During the execution of waiting time received data are not processed and the input buffer is blocked, i.e. displays are not refreshed during waiting time.

### Example

```
ISET 5; OUTPUT ON; USET 10; WAIT 0,100; USET 5
```

# 9 Status and Events Management

The device is furnished with special registers which can be queried by the controller in order to recognize programming errors (e.g. receipt of an incorrect command), device status (e.g. voltage regulating mode) or separate events (e.g. output has been deactivated by a protective function).

### Structure

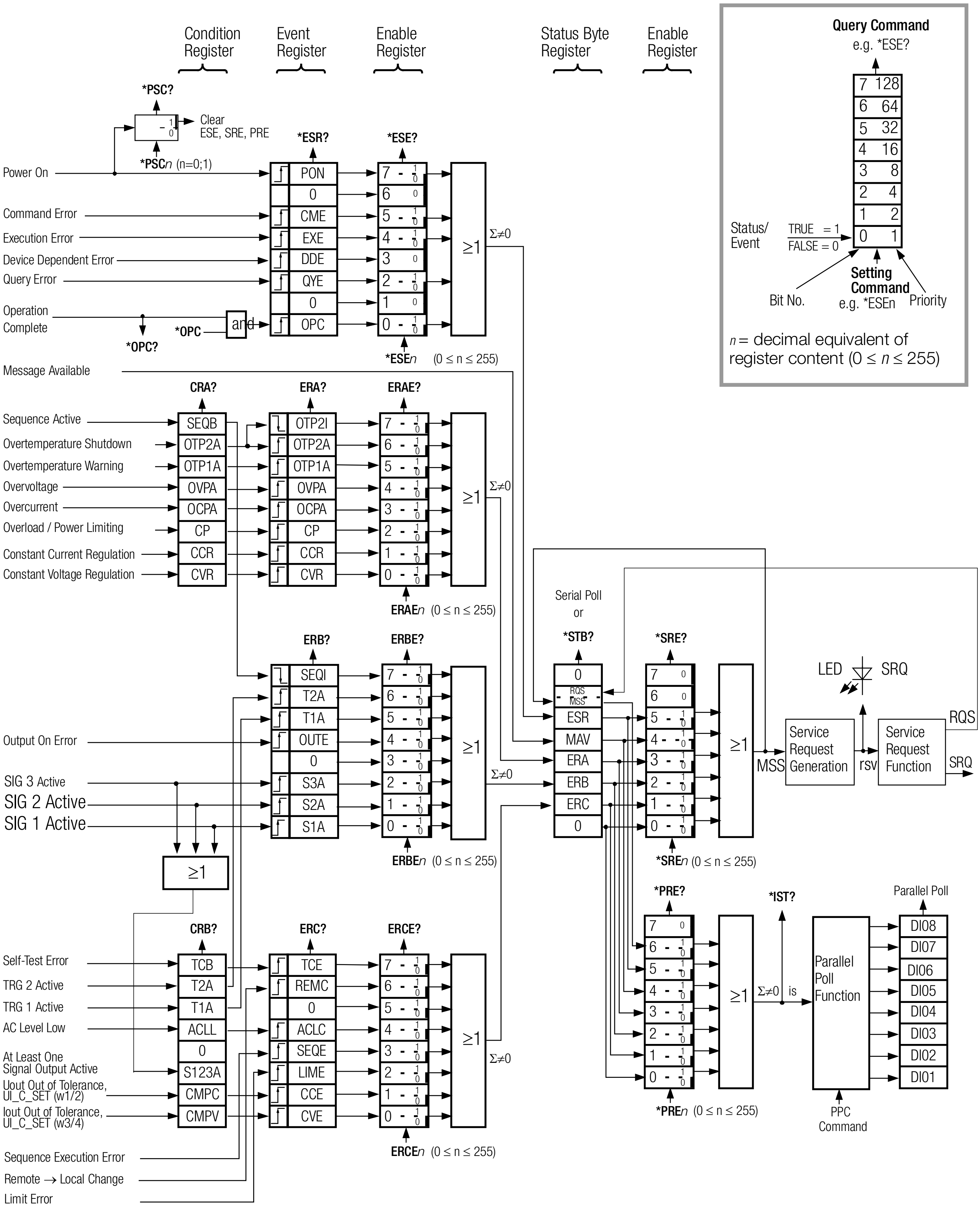



*Figure 9 Status and Events Management*

### Meaning of Register Contents

| Register Name | Meaning |
|---|---|
| ACLC | AC-LEVEL CHANGED (line voltage range has changed: H → L, L → H)) |
| ACLL | AC Level Low (line voltage < 182 $V_{rms}$) |
| CCE | Measured current values are outside of the tolerance band specified by means of UI_C_SET w1,w2,w3,w4 divided by w3,w4; ENABLE: "MINMAX ON" |
| CCR | Output is (was) in current regulating mode. |
| CVR | Output is (was) in voltage regulating mode. |
| CME | Unknown error, syntax error, standardized value limits for numeric parameters have been exceeded. |
| CMPC | Compare current: Measured current value not within the current tolerance band specified by UI_C_SET w1,w2,w3,w4 divided by w3,w4; ENABLE: "MINMAX ON" |
| CMPV | Compare voltage: Measured voltage value not within the voltage tolerance band specified by UI_C_SET w1,w2,w3,w4 divided by w1,w2; ENABLE: "MINMAX ON" |
| CVE | Measured voltage values are outside of the tolerance band specified by means of UI_C_SET w1,w2,w3,w4 divided by w1,w2; ENABLE: "MINMAX ON" |
| DDE | Internal device error is pending |
| EXE | Command-specific parameter limits exceeded, incompatibility of a command or a parameter with a momentary operating state. |
| LIME | Limit error:<br>error message after setting command for USET, ISET, UL_L, UL_H, IL_L, IL_H:<br>a) Setting range UL_L ≤ USET ≤ UL_H or IL_L ≤ ISET ≤ IL_H exceeded; or<br>b) Measuring range exceeded during voltage or current measurement<br>c) Limit errors may also occur during a sequence. Note regarding examination of limit and setting values. |
| MAV | Finished message following a query command: The requested information is available at the output buffer. |
| OCPA | Output deactivated by overcurrent protection (OCP function).<br>Switch back on with OUTPUT ON. |
| CP | Overload message: Power limiting has been triggered. |
| OPC | Finished message: Commands preceding the *OPC command have been executed (time synchronization). |
| OTP1A | Overtemperature warning: The device is overheated, e.g. due to obstructed vents. If overheating continues to increase, the output is switched off when the OTP2A threshold is reached. The OTP2A shutdown threshold is approx. 5 °C higher than the OTP1A warning threshold. |
| OTP2A | Overtemperature message and shutdown: The device is overheated, e.g. due to obstructed vents. The output is deactivated when this message is generated. The OUTPUT ON setting command is ignored as long as this condition persists, and causes setting of the OTP2A bit in the event register. |
| OTP2I | Ready for operation message after OTP2A overtemperature message: The device has cooled back down. If the POWER ON function is set to standby or reset, the output remains deactivated, if set to recall, automatic restart ensues. |
| OUTE | Output error: Error message, power output cannot be activated. Activation of the output is disabled by an internal hardware status, or is locked by means of the OUTPUT OFF signal at the trigger input of the analog interface. Display: "Err 73" |
| OVPA | Overvoltage protection has been triggered, the output has been deactivated. Switch back on with OUTPUT ON. |
| PON | Device was intermittently switched off, or an intermittent mains failure has occurred. |
| QYE | Error message after addressing as "talker": No message is (yet) available at the output buffer. |
| REMC | Status change: REMOTE → LOCAL (manual operation ensues) |
| S1A | SIG 1, active signal has occurred. |
| S2A | SIG 2, active signal has occurred. |
| S3A | SIG 3, active signal has occurred. |
| S123A | Signal output SIG 1 or/and SIG 2 or/and SIG 3 at the analog input is active. |
| SEQB | Status message: The sequence function is active (run, halt). |
| SEQI | Finished message: The sequence function is finished or has been aborted (inactive) (ready). |
| SEQE | Error message resulting from the sequence function. |
| T1A | A signal has occurred at trigger input TRG 1 of the analog interface with the following setting: trigger mode ≠ oFF. |
| T2A | A signal has occurred at trigger input TRG 2 of the analog interface with the following setting: trigger mode ≠ oFF. |
| TCB | TST or ADJUSTCAL function active |
| TCE | Self-test error or error during ADJUST has occurred. |

### Description of the Registers

#### Condition Register (CRA, CRB)

The individual bits in the condition register reflect the current status of a specific device function:

0 = status does not apply (FALSE)

1 = status applies (TRUE)

The content of the condition register can be read out with the help of a query command, but cannot be directly edited or cleared.

#### Event Registers – Standard Event Register (ESR), Event Registers (ERA, ERB, ERC)

The event registers acquire and save changes to specific device functions. The corresponding bit in the event register is set (1 = TRUE) if the associated function:

– Changes from FALSE to TRUE (with input ⌐) or

– Changes from TRUE to FALSE (with input ¬L).

The four event registers can be queried individually. The content of an event register is cleared when it's queried. An enable register is assigned to each event register.

#### Enable Registers –
#### Standard Event Enable Register (ESE), Event Enable Registers (ERAE, ERBE, ERCE),
#### Service Request Enable Register (SRE), Parallel Poll Enable Register (PRE)

The enable registers determine which bit(s) from the associated register or status byte register is (are) capable of influencing the respective group message (masking). The respective group message is set (1 = TRUE), as long as at least one bit enabled to this end has a status of TRUE.

The six enable registers can be written to and queried separately. The content of the registers is not changed by queries. Enable registers ERAE, ERBE and ERCE are set to zero when the device is switched off. Enable registers ESE, SRE and PRE are only cleared as a result of shutdown if the PSC bit is set to 1.

#### Status Byte Register (STB)

The status byte register contains:

– The statuses of the group messages from the three registers in bits 1, 2, 3 and 5

– The status of the data output buffer in bit 4
(empty → MAV = 0, not empty → MAV = 1)

– The status of group message MSS consisting of bits 1, 2, 3, 4 and 5, masked by enable register SRE, in bit 6

– Bits 0 and 7 are not used and are always set to "0".

Register contents can be read out:

– With the ***STB?** command, or

– In the case of IEC bus control, with the "Serial Poll" interface command In this case, bit 6 shows the RQS status, which is reset (0) after serial polling has been completed.

The ***CLS** setting command clears all of the event registers and the status byte register with the exception of the MAV bit, and cancels any pending SRQ message.

#### Power On Status Clear Bit Error

The power on status clear bit determines whether or not the content of enable registers ESE, SRE and PRE will be cleared when the device is switched off.

The PSC bit can be set and queried:

Settings: ***PSC** *n* *n* = 0: ESE, SRE and PRE are not cleared.
*n* = 1: ESE, SRE and PRE are cleared.

Query: ***PSC?** Response: "0" or "1"

The PSC bit setting also remains unchanged after the device is switched off, or after the ***CLS** command has been executed.

#### Operation Complete Bit (OPC)

See *OPC and *OPC? commends for a description of the respective function.

# 10 Table of Operating and Query Commands

## 10.1 Adjustable Functions and Parameters

| Setting Command | Parameter | Meaning | Value Range / Selection | Default settings after RESET *RST | Manual | Remote |
|---|---|---|---|---|---|---|
| **Display and interface settings (see section 6, Main Menu Level, SETUP DISPLAY & INTERFACE)** | | | | | | |
| Addr | n | Set device address for IEEE 488 (interface configuration) | 0 ≤ n ≤ 30 | unv | X | |
| bAUd | txt | **RS 232** transmission speed | Set via menu selection, default setting: 9600 baud<br>The following values can be selected manually:<br>1200, 1800, 2400, 3600, 4800, 7200, 9600, 14,400, 19,200, 28,800, 38,400, 57,600 or 115,200 [baud] | unv | X | |
| DB | | **RS 232** data bits | 7, 8, set via selection menu, default setting: 8 | unv | X | |
| PB | | **RS 232** parity bit | Set via menu selection, default setting: none<br>The following values can be selected manually: nonE, EVEn or odd | unv | X | |
| SB | | **RS 232** stop bit | 1, 2, default setting: 1 | unv | X | |
| bAUd | txt | **USB** transmission speed<br><br>(DB = 8, PB = no, SB = 1) | Set via menu selection, default setting: 115200 baud<br>The following values can be selected manually:<br>9600, 14,400, 19,200, 28,800, 38,400, 57,600, 115,200 [baud] | unv | X | |
| DDC | n | Display switching time | Set via menu selection, default setting: 10 seconds.<br>The following values can be selected manually: 5, 10, 15, 20, 30, 45, 90, 180 [s] | unv | X | |
| | | | | | | |
| **General Commands and Settings** | | | | | | |
| ***CLS** | | Clear status | | — | | X |
| ***DDT** | txt | Define device trigger | txt Command string with up to 80 characters,<br>delimiter for commands is slash (/) instead of semicolon (;) | — | | X |
| ***ESE** | n | Standard event status enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |
| ***OPC** | | Operation complete | | — | | X |
| ***PRE** | n | Parallel poll enable register enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |
| ***PSC** | n | Power-on status clear | n = 0, 1 | — | | X |
| ***RCL** | n | Recall a device setting stored to a setup memory location (1 through 12/15) | 1 ≤ n ≤ 12/15*;<br>Special case n = 99 means undo after *RST, *RCL # | — | X | X |
| ***RST** | | Reset device to default values | | Default | X | X |
| ***SAV** | n | Save current device settings<br>to a setup memory location (1 through 12/15) | 1 ≤ n ≤ 12/15* | — | X | X |
| ***SRE** | n | Service request enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |
| ***TRG** | | Trigger for executing *DDT functions | | — | | X |
| ***WAI** | | Wait to continue | | — | | X |
| DCL / SDC | | Device clear function | | — | | X |
| ERAE | n | Device dependent event register A enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |
| ERBE | n | Device dependent event register B enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |
| ERCE | n | Device dependent event register C enable | 0 ≤ n ≤ 255, n = decimal equivalent of register content | — | | X |

* /15 or /1700 as of firmware version 004

| Setting Command | Parameter | Meaning | Value Range / Selection | Default settings after RESET *RST | Manual | Remote | |
|---|---|---|---|---|---|---|---|
| **Device-specific settings** | | | | | | | |
| **ADJ**UST (CAL) | txt(,w) | Balancing/calibration function | UOFF / UFS / IOFF / IFS / (EXIT), 0 ≤ w ≤ respective balancing limit<br>The specified order for the procedure must be adhered to!<br>“EXIT” → UNCAL, abort with error message | — | X | X | |
| **ANA**LOG_IN | txt1,txt2 | Connection of analog control inputs U(Uext), U(Iext) | OFF / ON / SSET | OFF | X | X | |
| **C_D**YN | txt | Setting for current regulating dynamics | R / L | R | X | X | |
| **DI**SPLAY | txt1,txt2 | Digital display function switching | txt1: ON / OFF / UO /US / PS<br>txt2: ON / OFF / IO / IS / PO | UO<br>IO | X | X | |
| **FS**ET | txt | Sequence function parameter | CLR / NF / RU / RI / SOFF / S_ON / AUOF / AUON / AUSS / AIOF / AION / AISS / R01 … R12/15* / S01 … S12/15* | CLR | X | X | |
| **IL_H** (**ILI**M) | w | Upper limit value for current setting | Iset ≤ w ≤ Inom [A] | Inom | X | X | |
| **IL_L** | w | Lower limit value for current setting | 0 ≤ w ≤ Iset [A] | 0 | X | X | |
| **IS**ET | w | Current setpoint [A] | IL_L ≤ w ≤ IL_H [A] | 0 | X | X | |
| **MEAS_LP**F | txt | Low-pass filter for measured value acquisition | 1 / 2 / 3 / 4 | 3 | X | X | |
| **MI**NMAX | txt | Min-max storage for measured U and I values | OFF / ON / RST<br>**“ON”** → enable tolerance band function for CRB.0/1, ERC.0/1, SIGx-_OUT | OFF | X | X | |
| **OC_D**ELAY | w | Overcurrent protection trigger delay | 0,000 ≤ w ≤ 65,535 [s] | 0 | X | X | |
| **OCP** | txt | Overcurrent protection | OFF / ON / R01 ... R12/15* | OFF | X | X | |
| **OCS**ET | w | Overcurrent protection trigger value | OCSETmin (3) [A] ≤ w ≤ OCSETmax (80 A) [A] | 80 A | X | X | |
| **OU**TPUT | txt | Switch power output on and off | OFF/ ON | OFF | X | X | |
| **OV_D**ELAY | w | Surge protection triggering delay | 0,000 ≤ w ≤ 65,535 [s] | 0 | X | X | |
| **OVP** | txt | Surge protection | OFF / ON / R01 ... R12/15* | ON | X | X | |
| **OVS**ET | w | Surge protection trigger value | 3 [V] ≤ w ≤ OVSETmax (80 V) [V] | 80 V | X | X | |
| **POW**ER_ON | txt | Response after power on | RST / SBY / RCL / R01 ... R12/15* | RST | X | X | |
| **PS**ET | w | Power setpoint [W] | 0 ≤ w ≤ Pnom (1500, 3000, 4500) [W] (PSET = PNOM) → P-REG. OFF) | Pnom | X | X | |
| **RE**PETITION | n(,i) | Number of repetitions for sequence function | 0 ≤ n ≤ 255; 0 means continuous repetition.<br>i is an optional parameter for setup memory (1 … 12/15),<br>to which REPETITION should be written directly. | 0 | X | X | |
| **SEQ**UENCE | txt(,n) | SEQUENCE control command | OFF / GO / HOLD / CONT(,n) / STRT / STEP (,n) / BSTP / STOP / ESC<br>n is an optional parameter from start address to stop address | — | X | X | |
| **SIG**123 | txt1,txt2,txt3 | Analog interface signal outputs | OFF / ON / OUT / MODE / SEQ / SSET / U_LO / U_HI / I_LO / I_HI | OFF | X | X | |
| **SINK** | txt | Sink function on/off | OFF / ON | ON | X | X | |
| **SM_L**OAD | n | Query sequence memory location USET,ISET,TSET,FSET | 1 ≤ n ≤ 1536/1700* | — | X | X | |
| **SM_S**TORE | n | Write current USET,ISET,TSET,FSET to sequence memory location | 1 ≤ n ≤ 1536/1700*<br>n = 0: clear contents from start to stop address | — | X | X | |
| **SS**ET | txt | Command for an assigned switching function | OFF / ON | OFF | X | X | |
| **STA**RT_STOP | m,n(,i) | Start and stop address | 1 ≤ n1 ≤ n2 ≤ 1536/1700*<br>i is an optional parameter for setup memory (1 … 12/15),<br>to which START_STOP should be written directly. | 1.1 | X | X | |
| **STO**RE | n,w1,w2,w3,txt | Transfer parameters directly to memory | 1 ≤ n ≤ 1536/1700*, memory location address<br>0 ≤ w1 ≤ Unom [V]<br>0 ≤ w2 ≤ Inom [V]<br>0 ≤ w3 ≤ 65.535 [s], 0 means Tdef<br>txt, see “FSET” | — | X | X | |
| **T_M**ODE | txt1,txt2 | Function selection for trigger inputs | OFF / OUT / SQS / SEQ(,n) / LLO / MIN (,n) / AIX / AIU / AII | OFF | X | X | |
| **TD**EF | w(,i) | Default time rate for SEQUENCE function | 0,001 ≤ w ≤ 65,535 [s]<br>i is an optional parameter for setup memory (1 … 12/15*),<br>to which TDEF should be written directly. | 0,001 | X | X | |
| **TIME**DATE | txt | Set system clock (RTC) | yyyy-mm-ddThh:mm:ss | unv | X | X | |
| **TS**ET | w | Memory location-specific dwell time for SEQUENCE function | 0,000 = Tdef, 0,001 ≤ w ≤ 65,535 [s] | 0,000 | X | X | |
| **UI**_C_SET | w1,w2,w3,w4 | Reference values for Uout/Iout, tolerance band function | w1, w2: 0 ≤ w1 < w2 ≤ Unom [V]<br>w3, w4: 0 ≤ w3 < w4 ≤ Inom [A] | 0,Unom,<br>0, Inom | X | X | |
| **UL_H** (**ULI**M) | w | Upper limit value for voltage setting | Uset ≤ w ≤ Unom [V] | Unom | X | X | |
| **UL_L** | w | Lower limit value for voltage setting | 0 ≤ w ≤ Uset [V] | 0 | X | X | |
| **US**ET | w | Voltage setpoint [V] | UL_L ≤ w ≤ UL_H [V] | 0 | X | X | |
| **WA**IT | w | Additional waiting time | 0,001 ≤ w ≤ 65,535 [s] | — | | X | |

**Abbreviated commands:** Some commands can be abbreviated by using the letters shown in boldface. Letters not printed in boldface can be left out, for example: “**OU**TPUT ON” = “OU ON”
As a rule, letters can be entered in upper or lower case.
**Stringing commands together:** Several commands is a single data string must be separated by semicolons “;”, for example: “USET 12; ISET 8.5; OUTPUT ON”
**Numeric parameter formats:** *m, n:* whole number (integer)
*w:* whole number, fixed or floating decimal point number with or without exponent, for example: “12.5”, “0012.5”, “1.25E1”, “+1.25 e+01”

* /15 or /1700 as of firmware version 004

## 10.2 Queriable Functions and Parameters

| Query Command | Meaning | Response Parameter | Values/Format | Manual | Remote | Sample Response | Re-sponse String Length |
|---|---|---|---|---|---|---|---|
| **General query commands** | | | | | | | |
| ***DDT?** | Define device trigger | txt | Delimiter for commands: ";" | | X | `USET 5.123;ISET 10;OUTPUT ON` | ≤ 80 |
| ***ESE?** | Standard event status enable query | n | 0 ≤ n ≤ 255 | | X | `127` | 3 |
| ***ESR?** | Standard event status register query | n | 0 ≤ n ≤ 255 | | X | `0` | 1 |
| ***IDN?** | Query device ID | txt | | | X | `GMC-I GOSSEN-METRAWATT,PSP1500 P060RU060P,0-Serie No 008 ,01. B01` | 63 |
| ***IST?** | Individual status query | n | n = 0, 1 | | X | `0` | 1 |
| ***LRN?** (i) | Query device settings (LEARN)<br>i is an optional parameter for setup memory (1 … 12/15), which should be read out directly. | txt | | | X | | |
| | **Sample response for *LRN?** | | | | | 0 10 20 30<br>`OUTPUT OFF;USET +010.000;ISET ` 1<br>`+010.000;PSET +01500.0;UL_L +0` 2<br>`00.000;UL_H +060.000;IL_L +000` 3<br>`.000;IL_H +060.000;OVP  ON;OVS` 4<br>`ET +080.000;OV_DELAY 00.000;OC` 5<br>`P OFF;OCSET +080.000;OC_DELAY ` 6<br>`00.000;POWER_ON RST;T_MODE OFF` 7<br>`,OFF;ANALOG_IN  OFF, OFF;SINK ` 8<br>` ON;C_DYN R;MEAS_LPF 3;MINMAX ` 9<br>`OFF;SIG123  OFF, OFF, OFF;SSET` 10<br>` OFF;FSET   NF;TDEF 01.000;TSE` 11<br>`T 00.000;START_STOP 0001,0005;` 12<br>`REPETITION 000;DISPLAY  UO, IO` 13 | 390 |
| ***OPC?** | Operation complete query | n | n = 0, 1 | | X | `1` | 1 |
| ***PRE?** | PPOLL enable register enable query | n | 0 ≤ n ≤ 255 | | X | `40` | 2 |
| ***PSC?** | Power-on status clear query | n | n = 0, 1 | | X | `0` | ≤ 3 |
| ***SRE?** | Service request enable query | n | 0 ≤ n ≤ 255 | | X | `32` | ≤ 3 |
| ***STB?** | Read status byte query | n | 0 ≤ n ≤ 127 | | X | `16` | ≤ 3 |
| ***TST?** | Self-test function | n | n = 0, 1 | | X | `0` | 1 |
| **CRA?** | Condition register A | n | 0 ≤ n ≤ 255 | X | X | `1` | ≤ 3 |
| **CRB?** | Condition register B | n | 0 ≤ n ≤ 255 | X | X | `0` | ≤ 3 |
| **ERA?** | Device dependent event register A query | n | 0 ≤ n ≤ 255 | X | X | `1` | ≤ 3 |
| **ERAE?** | Device dependent event register A enable query | n | 0 ≤ n ≤ 255 | | X | `240` | ≤ 3 |
| **ERB?** | Device dependent event register B query | n | 0 ≤ n ≤ 255 | X | X | `0` | ≤ 3 |
| **ERBE?** | Device dependent event register B enable query | n | 0 ≤ n ≤ 255 | | X | `128` | ≤ 3 |
| **ERC?** | Device dependent event register C query | n | 0 ≤ n ≤ 255 | X | X | `64` | ≤ 3 |
| **ERCE?** | Device dependent event register C enable query | n | 0 ≤ n ≤ 255 | | X | `0` | ≤ 3 |
| **Device-specific functions and queries** | | | | | | | |
| **ANA**LOG_IN**?** | Connection of analog control inputs U(Uext), U(Iext) | txt1,txt2 | OFF/ ON / SSET | xx | X | `ANALOG_IN   ON, OFF` | 19 |
| **C_D**YN**?** | Setting for current regulating dynamics | txt | R / L | X | X | `C_DYN R` | 7 |
| **DI**SPLAY**?** | Digital display function switching | txt1,txt2 | txt1: ON / OFF / UO /US / PS<br>txt2: ON / OFF / IO / IS / PO | xx | X | `DISPLAY  UO, PO` | 15 |
| **ERR**OR**?** | List of error messages | n1,n2,n3,n4 | n1,n2,n3: last error<br>n4: µC-RSTSRC register | X [1] | X | `ERROR 032,031,000,001` | 21 |
| **FS**ET**?** | Sequence function parameter | txt | CLR / NF / RU / RI / SOFF / S_ON / AUOF / AUON / AUSS / AIOF / AION / AISS / R01 … R12/15* / S01 … S12/15* | X | X | `FSET   NF` | 9 |
| **IL_H?** (**ILIM?**) | Upper limit value for current setting | w | +XXX.XXX [A] | X | X | `IL_H +060,000` | 13 |
| **IL_L?** | Lower limit value for current setting | w | +XXX.XXX [A] | X | X | `IL_L +000,000` | 13 |
| **IMA**X**?** | Max. measured current value | w | +XXX.XXX [A] | X | X | `IMAX +000,212` | 13 |
| **IMI**N**?** | Min. measured current value | w | +XXX.XXX [A] | X | X | `IMIN +000,204` | 13 |
| **IO**UT**?** | Presently measured current value | w | +XXX.XXX [A] | X | X | `IOUT +000,208` | 13 |
| **IS**ET**?** | Selected current setpoint | w | +XXX.XXX [A] | X | X | `ISET +015,000` | 13 |
| **MEAS_LP**F**?** | Low-pass filter for measured value acquisition | txt | 1 / 2 / 3 / 4 | X | X | `MEAS_LPF 3` | 10 |

[1] Manual: last error only
xx: Manual: breakdown into sub-functions

| Query Command | Meaning | Response Parameter | Values/Format | Manual | Remote | Sample Response | Re-sponse String Length |
|---|---|---|---|---|---|---|---|
| **MI**NMAX**?** | Min-max storage for measured U and I values | txt | OFF / ON<br>"ON" → enable tolerance band function for CRB.0/1, ERC.0/1, SIGx-_OUT | X | X | `MINMAX OFF` | 10 |
| **MO**DE**?** | Momentary control mode of the power output | txt | CV / CC / CP / OL / OFF | LED | X | `MODE  CV` | 8 |
| **OC_D**ELAY**?** | Overcurrent protection trigger delay | w | 0,000 ≤ w ≤ 65,535 [s] | X | X | `OC_DELAY 00,000` | 15 |
| **OCP?** | Overcurrent protection | txt | OFF / ON / R01 ... R12/15* | X | X | `OCP OFF` | 7 |
| **OCS**ET**?** | Overcurrent protection trigger value | w | +XXX.XXX [A] | X | X | `OCSET +080,000` | 14 |
| **OU**TPUT**?** | Output on/off status | txt | OFF/ON | LED | X | `OUTPUT  ON` | 10 |
| **OV_D**ELAY**?** | Surge protection triggering delay | w | XX.XXX [s] 0 ≤ w ≤ 65,535 [s] | X | X | `OV_DELAY 00,000` | 15 |
| **OVP?** | Surge protection | txt | OFF / ON / R01 ... R12/15* | X | X | `OVP  ON` | 7 |
| **OVS**ET**?** | Surge protection trigger value | w | +XXX.XXX [V] | X | X | `OVSET +080,000` | 14 |
| **PO**UT**?** | Current output power | w | +XXXXX.X [W] | X | X | `POUT +00002.1` | 13 |
| **POW**ER_ON**?** | Response after power on | txt | RST / SBY / RCL / R01 ... R12/15* | X | X | `POWER_ON SBY` | 12 |
| **PS**ET? | Power setpoint [W] | w | +XXXXX.X [W]<br>W = Pnom (Pnom/2 at 115 V AC) [1]<br>W ≤ Pnom (Pset < Pnom/2 at 115 V AC) [2] | X | X | `PSET +01500.0` | 13 |
| **RE**PETITION**?** (i) | Number of repetitions for sequence function<br>i is an optional parameter for setup memory (1 … 12/15*), which should be read out directly. | n | 0 ≤ n ≤ 255;<br>0 means continuous repetition | X | X | `REPETITION 000` | 14 |
| **RL**OAD? | Momentary load resistance [calculated value R = U/I] | w | +XXX.XXX [Ω] | X | X | `RLOAD +030,833` | 14 |
| **SEQ**UENCE**?** | SEQUENCE status | txt,n1,n2,n3 | txt: RDY / HALT / RUN<br>n1: 000 ≤ n1 ≤ 012/15* (setup memory)<br>n2: 001 ≤ n2 ≤ 255 (remaining repetitions),<br>n2 = 999 = continuous<br>n3: 0001 ≤ n3 ≤ 1536/1700* (memory location) | xx | X | `SEQUENCE  RDY,000,999,0005` | 26 |
| **SIG**123**?** | Analog interface signal outputs | txt1,txt2,txt3 | OFF / ON / OUT / MODE / SEQ / SSET / U_LO / U_HI / I_LO / I_HI | X | X | `SIG123 MODE, OUT, OFF` | 21 |
| **SINK?** | Sink function on/off | txt | OFF/ON | X | X | `SINK  ON` | 8 |
| **SS**ET**?** | Status of an assigned switching function | txt | OFF/ON | X | X | `SSET OFF` | 8 |
| **STA**RT_STOP**?** (i) | Start and stop address<br>i is an optional parameter for setup memory (1 … 12/15), which should be read out directly. | m,n | 1 ≤ n1 ≤ n2 ≤ 1536/1700* | xx | X | `START_STOP 0001.0005` | 20 |
| **STO**RE**?** (m(,n(,tab))) | Read data from sequence memory See "Descriptions of Operating Commands" for further details. | n,w1,w2,w3,txt | n: Memory address<br>v1: +XXX.XXX [V]<br>v2: +XXX.XXX [A]<br>v3: XX.XXX [s]<br>txt: "FSET" | xx | X | `STORE 0003,+020.000,+015.000,00.000,  NF` | 40 |
| **T_M**ODE**?** | Function status for trigger inputs 1 and 2 | txt1,txt2 | OFF / OUT / SQS / SEQ(,n) / LLO / MIN (,n) / AIX / AIU / AII | X | X | `T_MODE OUT,LLO` | 14 |
| **TD**EF**?** (i) | Default time for sequence function<br>i is an optional parameter for setup memory (1 … 12/15), which should be read out directly. | w | 0,001 ≤ w ≤ 65,535 [s] | X | X | `TDEF 01,000` | 11 |
| **TIM**EDATE**?** | System clock time/date (RTC) | txt | yyyy-mm-ddThh:mm:ss | xx | X | `TIMEDATE 2007-10-08T12:27:13` | 28 |
| **TS**ET**?** | Memory location-specific dwell time for SEQUENCE function | w | 0,000 ≤ w ≤ 65,535 [s]<br>0,000 = Tdef, | X | X | `TSET 00,000` | 11 |
| **UI**_C_SET**?** | Reference values for Uout/Iout, tolerance band function | w1,w2,w3,w4 [V][V][A][A] | w1, w2:  0 ≤ w1 < w2 ≤ Unom [V]<br>w3, w4:  0 ≤ w3 < w4 ≤ Inom [A] | xx | X | `UI_C_SET +000.000,+060.000,+000,000,+060,000` | 44 |
| **UL_H?** (**ULIM**?) | Upper limit value for voltage setting | w | +XXX.XXX [V] | X | X | `UL_H +060.000` | 13 |
| **UL_L?** | Lower limit value for voltage setting | w | +XXX.XXX [V] | X | X | `UL_L +000.000` | 13 |
| **UMA**X**?** | Max. measured voltage value | w | +XXX.XXX [V] | X | X | `UMAX +010,004` | 13 |
| **UMI**N**?** | Min. measured voltage value | w | +XXX.XXX [V] | X | X | `UMIN +009,992` | 13 |
| **UO**UT**?** | Presently measured voltage value | w | +XXX.XXX [V] | X | X | `UOUT +009,998` | 13 |
| **US**ET**?** | Selected voltage setpoint | w | +XXX.XXX [V] | X | X | `USET +010,000` | 13 |

**Terminating device messages:** The following end-of-text characters can be used for data receipt: for IEC bus operation: NL (hex: 0A) or NL & EOI or DAB & EOI
for RS 232C remote control: NL or CR (hex: 0D) or ETB (hex: 17) or ETX (hex: 03).
The following end-of-message character is used when transmitting the response string: for IEC bus operation: NL & EOI;
for RS 232C control: last received end-of-message character.

**Abbreviated commands:** Some commands can be abbreviated by using the letters shown in boldface. Letters not printed in boldface can be left out, for example: "**OU**TPUT ?" = "OU?"
As a rule, letters can be entered in upper or lower case.

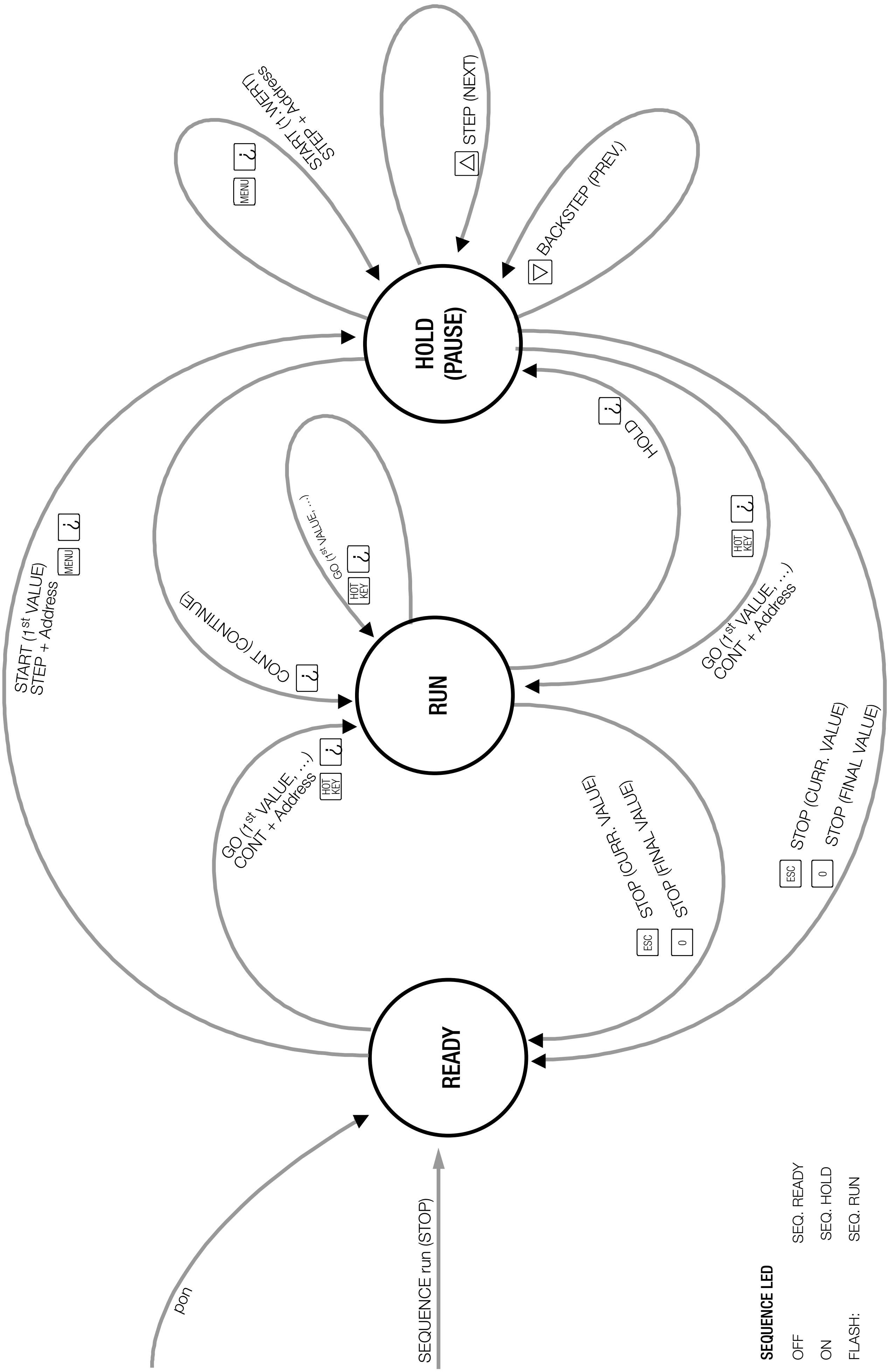
**Stringing commands together:** Several commands in a single data string must be separated by semicolons ";", for example: "USET?; ISET?; OUTPUT?"

[1] Constant voltage or constant current mode

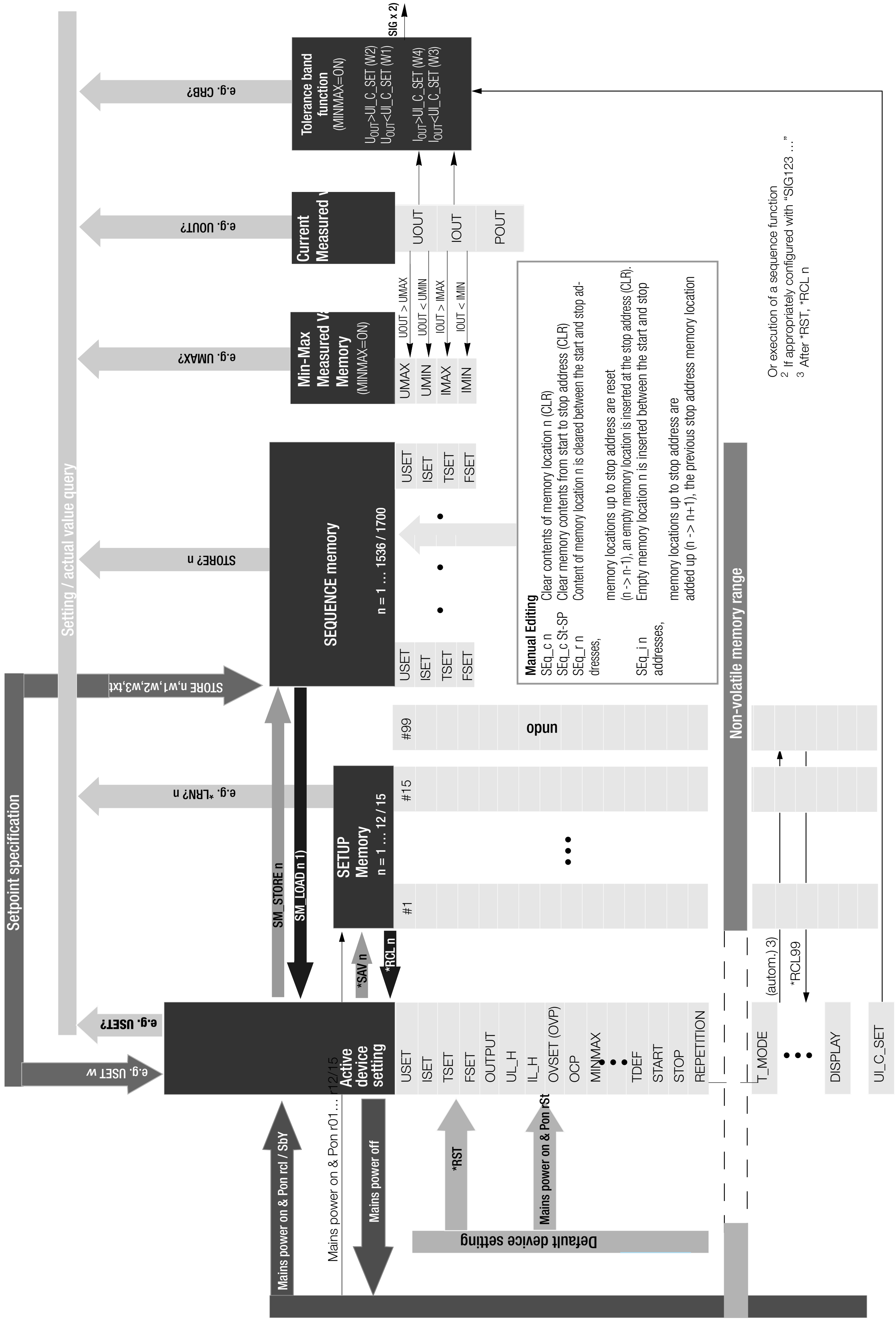
[2] Constant power mode

* /15 or /1700 as of firmware version 004 — xx: Manual: breakdown into sub-functions

## 10.3 Sequence Status Diagram



## 10.4 Memory Structure



# 11 System Messages

Procedures and entries are monitored in order to provide the user with support.

The device is capable of detecting and reading out a great variety of faulty procedures.

In the case of manual operation, the error appears directly at the display for a brief period of time. In addition to this, the last error message can be viewed with the help of the appropriate menu function.

*Err* appears at the left-hand display, and the three digit error code at the right-hand display.

In the case of operation with a PC, the last three error messages can be accessed by executing the ERROR? command (see **ERROR?** command in the section entitled “Descriptions of Operating Commands”).

| Code Err… | Meaning/Cause | Remedy |
|---|---|---|
| 00 | No error | |
| 01 | TYPE (BZ) detection | For internal production sequence only |
| 05 | UNKNOWN KEYCODE, or in case of “LCL LOCKED”, [ESC] has been briefly activated for enabling | |
| 12 | CMD buffer overflow | Overflow at internal CMD buffer |
| 21 | USET, ISET, PSET (parameter error) | |
| 22 | UL,IL (parameter error) | |
| 29 | DDTE *DDT command string > 80 characters or ?*TRG? within *DDT… | |
| 31 | CME command error | General |
| 32 | EXE execution error | General |
| | | |
| | **INTERFACE** | |
| 51 | RS 232, PB, parity bit | |
| 52 | RS 232, SB, stop bit | |
| 53 | PB + SB, RS 232 | |
| 54 | RS232, FRAME OVERFLOW (impermissible combination DB/PB/SB) | Only occurs during manual configuration |
| 55 | Active talker state but no listener present | Only possible with IEEE 488 interface option |
| 56 | IEC$LATA$ERR (active listener and active talker) | Only possible with IEEE 488 interface option |
| 61 | ADJUST parameter error | |
| 62 | Impermissible ADJUST order (REMOTE) | |
| 63 | [U/I]-OFFSET/FULL SCALE -> (!) [CV/CC] MODE | Corresponding operating mode required! |
| 64 | ADJUST LIMITs or OFFSET (MEASUREMENT NEGATIVE or OVERFLOW) | |
| 66 | CALIBRATION ERROR/EXIT (-> UNCAL) | |
| 69 | MEMORY DATA (-> ERROR) ?) | Faulty data, possible cause: low battery |
| 71 | Table values(#): USET<UL_L, USET>UL_H, ISET<IL_L, ISET>IL_H | Limit error during sequence execution |
| 73 | OUTE: “OUTPUT ON” =/= Tx MODE “OUT” & Tx-SIG “OUT OFF” | Trigger mode power output and signal blocked (=OFF!) |
| 74 | TRGE: “MINMAX ON” =/= Tx MODE “MIN” & Tx-SIG “MINMAX OFF” | Min-max control for the trigger mode and signal blocked (=OFF!) |
| 75 | TRGE: “SEQUENCE ON” =/= Tx MODE “SEQ” & Tx-SIG “SEQUENCE STOP” | Sequence control for the trigger mode and signal blocked (=OFF!) |
| 76 | TRGE: “ANALOG INP” =/= Tx-MODE “AI?” & Tx-SIG (UEXT,IEXT) | Uext, Iext control for the trigger mode and signal blocked (=ON!) |
| 81 | RCL n (no data): SETUP memory n: invalid or no data | |
| 82 | START -> STOP - INVALID VALUES | |
| 83 | START-ADR > STOP-ADR | |
| 84 | Not (STOP_ADR < MEM < START_ADR) or SUB-SEQUENCE (cond.) | Address range or memory location is outside of the specified start-stop address or within an (active) subsequence; specify the sequence range to be deleted and resend the command. |
| 85 | CONTINUE (no initialization, status =/= “HALT”) | |
| 86 | SUB-SUBSEQUENCE impermissible | |
| 89 | “SEQUENCE OFF” required for current command | |
| 91 | SELFTEST (*TST?) | |
| 93 | Current instruction invalid for power control! | Impermissible combination of functions |
| 96 | MIN LIMIT UNDERFLOW | Direct numeric entry of a numeric value > UL_L or > IL_L required |
| 97 | MIN LIMIT UNDERFLOW | |
| 98 | MAX LIMIT OVERFLOW | |
| 99 | OVERLOAD / OVERFLOW | |
| | | |

| DISPLAY Left | Right | Meaning/Cause | Remedy |
|---|---|---|---|
| **Err** | **PFC** | PFC Error | Inadequate/unstable line voltage or device error, not ready for operation, device controls disabled, shutdown (OUTPUT OFF) |
| **Err** | **AC-H** | Change from AC-LOW to AC-HIGH | A transition from the “lower” AC_L mains voltage range to the “higher” AC_H range generates the “ERR AC-H” message.<br>Attention: a low PSET limit is not automatically increased! This necessitates renewed “Power On” with:<br>– Automatic RESET (parameter setting: “POWER_ON RST”) or<br>– Subsequent “RESET” (manual operation/interface) or<br>– Recall of a suitable SETUP memory<br>(which was not stored under power derating conditions!)<br>(Pnom, or Pnom/2 in case of derating, is the reference variable for the PSET function!) |
| **Err** | **AC-L** | Change from AC-HIGH to AC-LOW | **Up to and including firmware version 004:**<br>A transition from the “higher” mains voltage range to the “lower” range generates the “ERR AC-L” message and results in shutdown if power derating was not active (operation disabled, “Power On” required!)<br>A transition from the “higher” AC_H mains voltage range to the “lower” AC_L range generates the “ERR AC-L” message without shutdown if power derating was already active.<br><br>**As of firmware version 005:**<br>A transition from the “higher” mains voltage range to the “lower” range generates the “ERR AC-L” message and results in power derating, as long as the “AC LOW” “lower” mains voltage range status prevails. After mains voltage returns to the “upper” mains voltage range (“AC HIGH” state), power derating is deactivated. |
| **Err** | **AC-F** | AC-FAIL | Inadequate/unstable line voltage or device error, not ready for operation, device controls disabled, shutdown (OUTPUT OFF)<br><br>**As of firmware version 010:**<br>Temporary shutdown in order to protect the device.<br>In the event of insufficient or unstable mains voltage or if a device error occurs, the device is shut down (OUTPUT OFF) and cannot be operated during this time.<br>Automatic device restart begins after approximately 0.25 seconds in accordance with the POWER_ON settings (standby, reset, recall). |

RSTSRC (RESET SOURCE REGISTER):

Description / Text per Data Sheet C8051F122

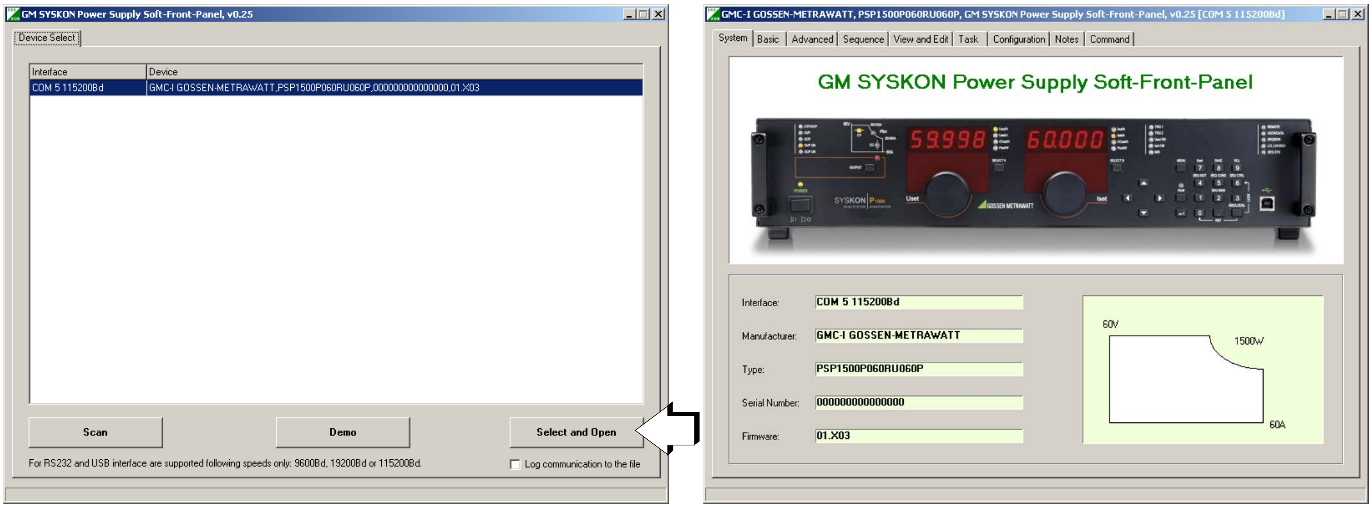
| | |
|---|---|
| D7 | (80H): RESERVED |
| D6 | (40H): CNVRSEF: (CONVERT START 0 RESET SOURCE FLAG) |
| D5 | (20H): CORSEF: (COMPARATOR 0 RESET FLAG) |
| D4 | (10H): SWRSF: SOFTWARE RESET FLAG |
| D3 | (08H): WDTRSF: WATCHDOG TIMER RESET FLAG |
| D2 | (04H): MCDRSF: MISSING CLOCK DETECTOR FLAG |
| D1 | (02H): PORSF: POWER-ON RESET FLAG |
| D0 | (01H): PINRSF: HW PIN RESET FLAG |

# 12 Operating Software

Comprehensive operating software is provided for the SYSKON Konstanter (as a download from our website).

The software is started by running the EXE file; no further installation is required.

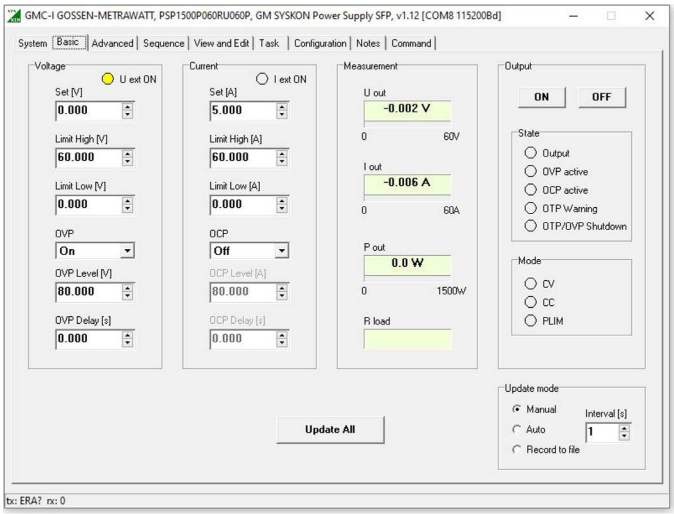
The software detects devices which are connected to the various possible interfaces including USB, RS 232 and GPIB. Devices detected by the software are identified and can be selected. If more than one device is connected, the software can be started several times in order to access them.



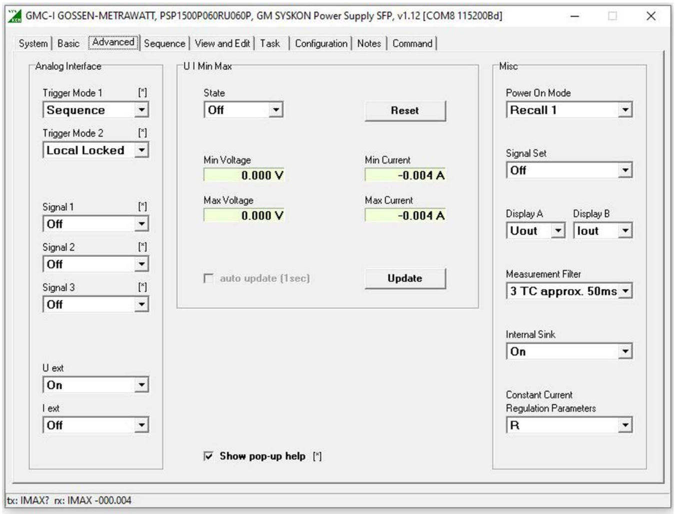

The activated device logs in via the system tab and is thus unequivocally recognized.

### Submenus

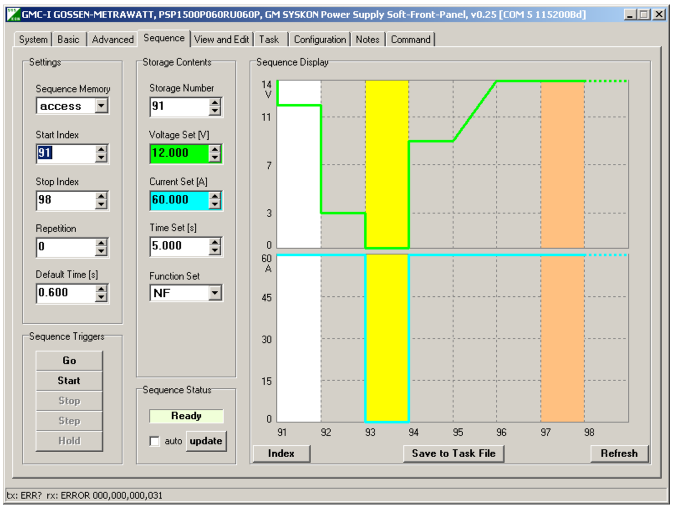
Further operation can be carried out as shown in the following figures.



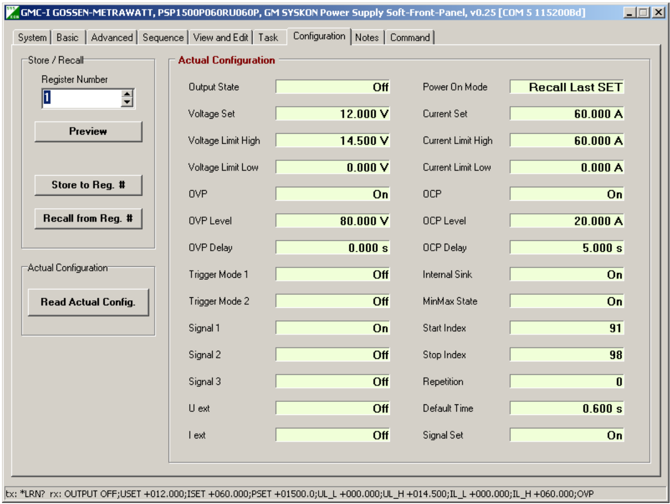

Basic Tab




Advanced Tab

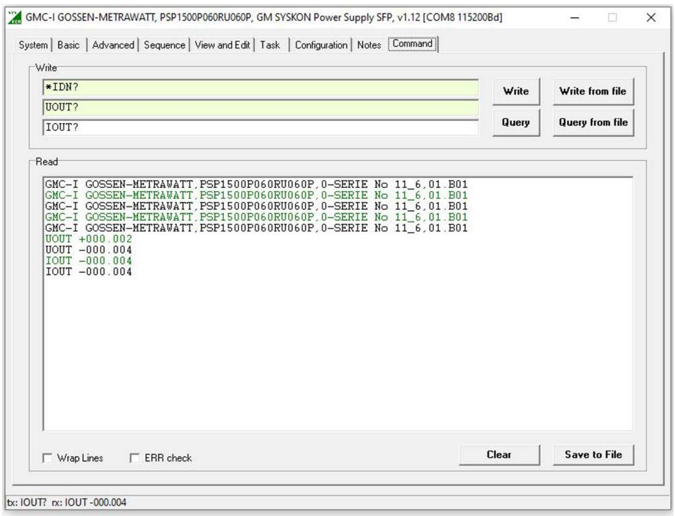



Sequence Tab




Configuration Tab


Task Tab




Command Tab

# 13 Index

## 14 Order Information

| Description (abbreviated name) | Article Number |
|---|---|
| SYSKON P500-060-030 SYSTEM KONSTANTER | K346A |
| SYSKON P800-060-040 SYSTEM KONSTANTER | K347A |
| SYSKON P1500-060-060 SYSTEM KONSTANTER | K353A |
| SYSKON P3000-060-120 SYSTEM KONSTANTER | K363A |
| SYSKON P4500-060-180 SYSTEM KONSTANTER | K364A |
| Optional IEEE488 interface for SYSKON KONSTANTER | K384A |

**Software**

Further information regarding operating software and drivers is available for download on the internet:

http://www.gossenmetrawatt.com

**Accessories**

| Description | Note | Article no. |
|---|---|---|
| RS 232 bus cable, 2 m | For connecting a device to an RS 232 interface (extension cable, 9-pin socket / 9-pin plug connector) | GTZ3241 000R0001 |

## 15 Contact, Support and Service

Gossen Metrawatt GmbH can be reached directly and conveniently – we have a single number for everything! Whether you require support or training, or have an individual inquiry, we can answer all of your questions here:

+49 911 8602-0

Monday to Thursday: 08:00 am - 4:00 pm
Friday: 08:00 am - 2:00 PM

Or contact us by e-mail at:

info@gossenmetrawatt.com

Do you prefer support by e-mail?

Measuring and Test Technology:

support@gossenmetrawatt.com

Industrial Measuring Technology:

support.industrie@gossenmetrawatt.com

Please contact GMC-I Service GmbH for repairs, replacement parts and calibration[1] :

+49 911 817718-0

service@gossenmetrawatt.com

www.gmci-service.com

Beuthener Str. 41
90471 Nürnberg
Germany

[1] DAkkS calibration laboratory per DIN EN ISO/IEC 17025 – accredited by the Deutsche Akkreditierungsstelle GmbH under reference number D-K-15080-01-01.

## 16 Manufacturer's Guarantee

The SYSKON Konstanter is guaranteed for a period of 2 years after shipment. The manufacturer's guarantee covers materials and workmanship. Damages resulting from use for any other than the intended purpose, as well as any and all consequential damages, are excluded.

Calibration is guaranteed for a period of 12 months.



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