Operating Instructions

HAEFELY TEST AG

Haefely Test AG

OT 257 DC

123-01

Version 1.00.00
Date 02.06.2008

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OK
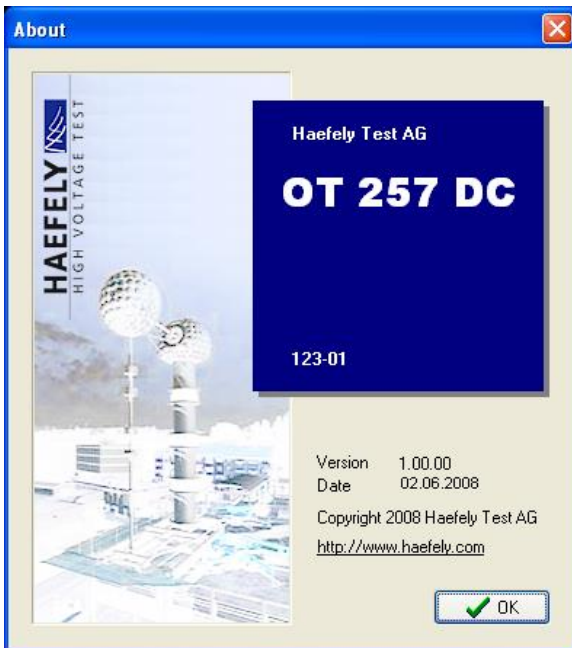
OT 257 DC

DC Generator
Operating Terminal

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OT 257 DC Manual Revision History

V1.0	06/2008	ThG	Initial release of the document
V1.1	03/2009	ThG	Sequences
V1.2	04.08.2011	HPM	Ripple measurement
V1.3	11.08.2011	HPM	Remote Option
V1.4	01.09.2011	ThG	Sequence, Reporting, AMP Connector
V1.5	06.09.2011	ThG	Remote: Connection Label
V1.6	07.11.2011	ThG	Grounding Switched Disabled
V1.7	24.06.2015	StC	Software Version 3.5.2
V1.8	06.07.2016	BK	Review of total manual.
V1.9	03.03.2017	BK	Software Version 3.5.3
V1.10	17.11.2017	BK	Connection information updated

Manual Conventions

In the manual, the following conventions are used:

Indicates a matter of note - if it refers to a sequence of operations, failure to follow the instructions could result in errors in measurement.

Indicates hazards. There is a risk of equipment damage or personal injury or death. Carefully read and follow the instructions. Be sure to follow any safety instructions given in addition to those for the site at which tests are being performed.

1 Index

2 Introduction

With the Haefely DC Operating Terminal the user has the possibility to control his DC system in a comfortable way. The test object and the DC system will be protected by trips. The error handling will be done by the system.

In manual mode the system will regulate itself to a user specified value. Increasing or decreasing the voltage manually is also possible.

All measured values are visible at once and error messages are displayed on most of the screens.

With a curve the history window will display the high voltage progress during the time.

In case of emergency it is always possible to switch high voltage off by pressing the emergency button.

3   Functional Description of the DC Control System

This chapter provides a short overview of a DC system and a short description of the individual control system modules (examples). You can find the detailed information in the User Guides of the specific systems.

Block Diagram of the Control System

```
┌─────────────────────┐   ┌─────────────────────┐
│     Regulator        │   │        Base          │
│                      │   │                      │
│  ┌────────────────┐  │   │  ┌────────────────┐  │
│  │ Connection box │  │   │  │ Connection box │  │
│  │   Regulator    │  │   │  │     Base       │  │
│  └────────────────┘  │   │  └────────────────┘  │
└─────────────────────┘   └─────────────────────┘
         │                          │
┌────────┼──────────────────────────┼──────────────┐
│  System Control                                   │
│  OT 257 DC                                        │
│            ┌──────────────────────┐               │
│            │      Interface        │              │
│            │      DIFa-DTC         │              │
│            └──────────────────────┘               │
│                      │                            │
│            ┌──────────────────────┐               │
│            │      Computer         │              │
│            └──────────────────────┘               │
│                      │                            │
│          ┌───────────┴───────────┐               │
│  ┌──────────────┐        ┌──────────────┐        │
│  │   Keyboard    │       │   Monitor     │        │
│  └──────────────┘        └──────────────┘        │
│         │                                         │
│  ┌──────────────┐                                 │
│  │    Mouse      │                                │
│  └──────────────┘                                 │
└───────────────────────────────────────────────────┘
```

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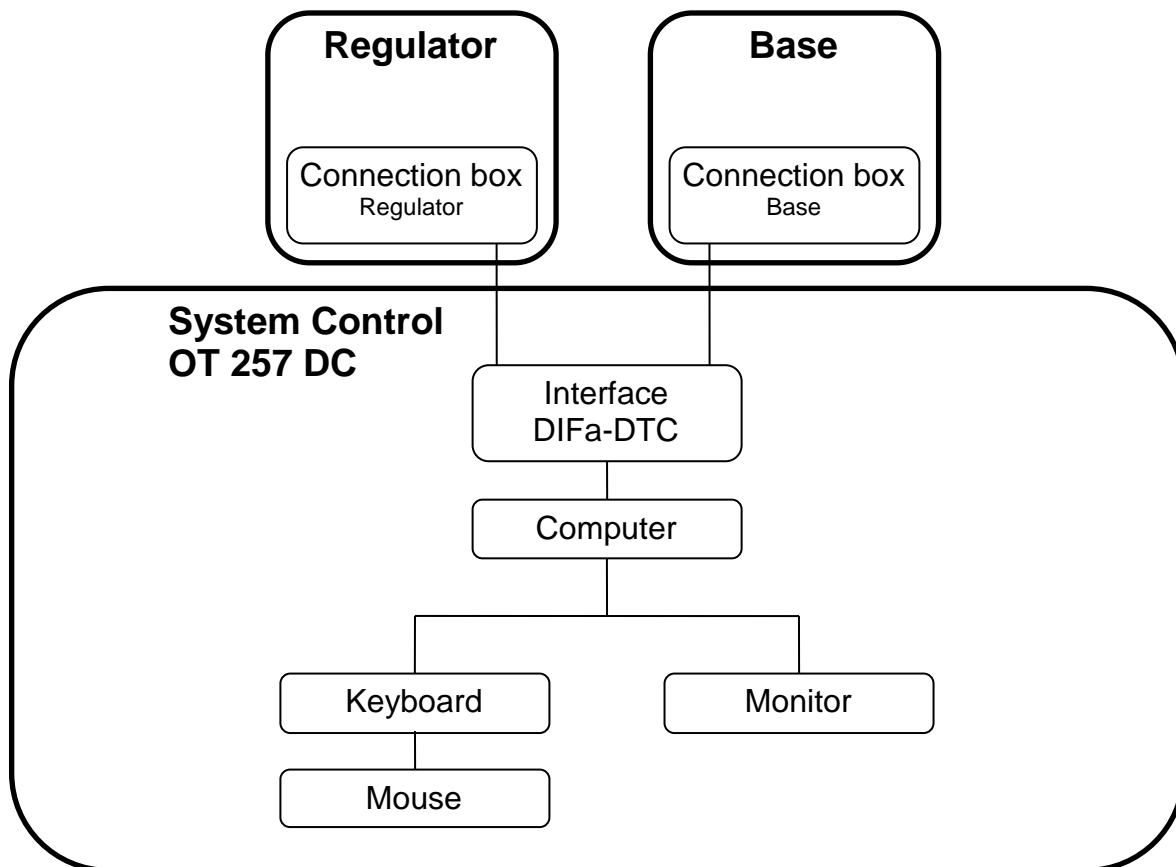
DC- System

DC Systems are assembled in various configurations. Each system comes with a User's Guide that exactly describes all system parts used.

The following system parts can be found in a DC system:

- regulator cabinet with
        primary and secondary power switch and load switch
        regulation transformer
        AC voltage and current measurement
        connection box regulator
- base with
        polarity change motor
        secondary units for DC voltage and measurement
        connection box base
- HVDC modules with
        internal polarity switch
        internal HV divider (standard)
- external high voltage divider (optional)
- control desk or control rack.

Connection Boxes

The *Connection boxes* are the interface between the Control System (DIFa-DTC device) and the front end and high voltage side of the DC System. The boxes are positioned within the regulator cabinet and the base of the HVDC system near the high voltage system parts and concentrate the individual control and measurement lines of the system into two control cables. The individual connections are detailed in the User's Guide for the DC Systems.

Mechanical Construction of the Desk

Front view: (example of a rack version)

Desk / Rack

OT257 DC is a modular system, available in desk or rack versions. The design of both systems is based on 19" rack elements. A short description of the individual modules follows. Detailed information is available in the User's Guide for each module.

Desk and rack are connected to the DC System with different cables. The interfaces are located on the control side of the *DIFA-DTC* module and on the system side for the connection box. All control inputs and outputs are protected against transient interference voltages and electromagnetic coupling. Part of the protection is provided by the shielded cables. As a result they must not, under any circumstance, be replaced by cables of other types.

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Module OT257DC (DC Control & Interface Module)

The Module *DIFa-DTC* is normally mounted in the mini rack the control system. It monitors and controls all warning, safety equipment and all other system parts. The input sockets are on the back side of the module.

All analogue and digital signals from the DC System are connected to this module. It matches the internal and external signal levels. It also filters the signals and removes interference from them.

View on the Back panel of the module
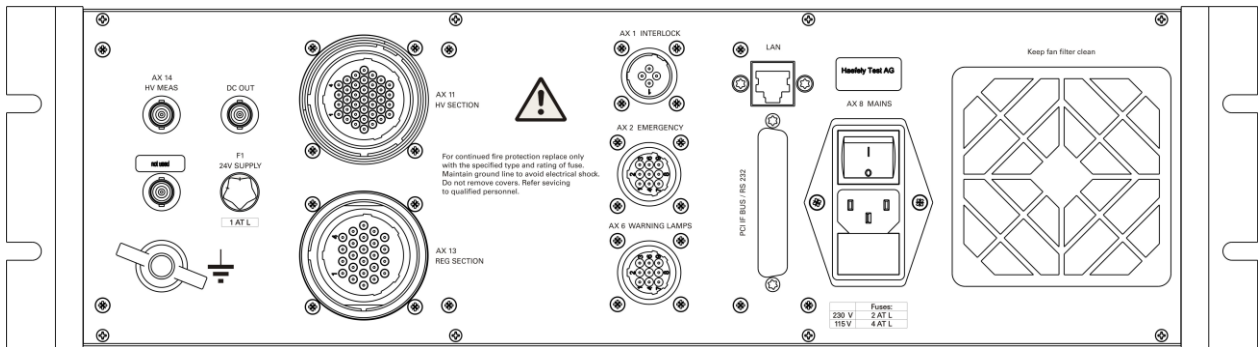
Used connectors

On the back panel of the module you find several connectors.

LAN (Ethernet) Connector

D Sub connector 37p.
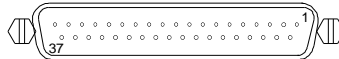
AMP series CPC 4p.
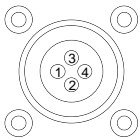
AMP series CPC 9p.
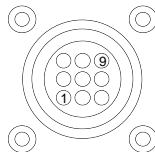
AMP series CPC 24p.
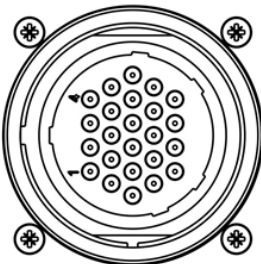
AMP series CPC 37p.
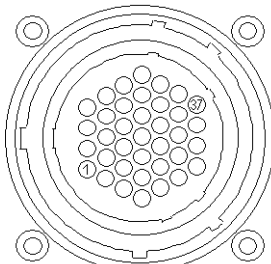
Connectors on the module

Connector	Designation	Type of connector	Description
A:X1	INTERLOCK	AMP Series CPC 4 poles male	Security circuit
A:X2	EMERGENCY	AMP Series CPC 9 poles male	Emergency switch
A:X6	WARNING LAMPS	AMP Series CPC 9 poles male	Warning lamps
A:X8	MAINS	IEC 3 poles male	Mains connector
A:X11	HV SECTION 1	AMP Series CPC 37 poles male	Connection Box Base
A:X13	REG SECTION	AMP Series CPC 24 poles male	Connection Box Regulator
A:X14	HV MEAS	BNC	High voltage measuring DC -200 .. 200 Vpp DC (60 nF || 20.12 MΩ)
A:X16	DC OUT	BNC	yt Plotter -10 .. 10 V DC proportional to high voltage, where 0 V 0 V high Voltage, -10 V - Max Connection voltage 10 V + Max Connection Voltage
A:X18	+24 V DC	BNC	+24 V DC 5.5W
	LAN	RJ-45	Process computer PCI811
	PCI IF BUS	D-Sub 37 poles male	

Pinning of the connectors

Pinning connector A:X1

A:X1	INTERLOCK
Pin	Signal
1	Interlock Stat (Status) <--
2	Interlock Cmd (Command) --> 24 V DC
3	Shield
4	Not connected

Pinning connector A:X2

A:X2	EMERGENCY
Pin	Signal
1	Not connected
2	Not connected
3	Not connected
4	Not connected
5	Emergency Cmd (Customer)
6	Emergency Stat (Customer)
7	Emergency Cmd (System) -->
8	Emergency Stat (System) <--
9	Shield

Functional Description of the DC Control System

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Pinning connector A:X6

A:X6	WARNING LAMPS
Pin	Signal
1	Warning Lamp (external Supply) Max. 250 V AC / 3A
2	Warning Lamp Red
3	Warning Lamp Green
4	Not connected
5	Not connected
6	Not connected
7	Not connected
8	Not connected
9	Not connected

Pinning connector A:X8

A:X8	MAINS
Pin	Signal
L	Phase
N	Null
PE	Protective earth

Pinning connector A:X11

A:X11	HV SECTION 1
Pin	Signal
1	DC Curr. H
2	DC Curr. L
3	Earth
4	
5	
6	
7	
8	
9	
10	
11	
12	Polarity Switch Disabled
13	Shorted Stat
14	- Polarity Stat
15	+ Polarity Stat
16	
17	Gnd Break Cmd
18	Polarity Cmd
19	Polarity Cmd 2nd Stack[1]
20	Gnd Switch Cmd[2]
21	Gnd Switch Status
22	Gnd Break Status
23	+24 V
24	GND
25	Aux. DC In H

Pinning connector A:X13

A:X13	REG SECTION
Pin	Signal
1	Reg. Volt. H
2	Reg. Volt. L
3	Earth
4	Reg. Curr. H
5	Reg. Curr. L
6	Earth
7	Security End Switch
8	Reg. Mot. Speed H
9	Reg. Mot. Speed L
10	Flash
11	Emergency CMD
12	Power Status
13	Power On
14	Power Off
15	Trip Regulator
16	Voltage Up
17	Voltage Down
18	Alarm Regulator
19	Regulator Pos Min
20	Regulator Pos Max
21	HV Switch Off / On
22	HV Status
23	+24 V
24	GND

[1] Pulsed for sec will start to change polarity. Between positive and negative polarity it should be in started state for some seconds.

[2] Optional with external Grounding System

26	Aux. DC In L
27	Earth
28	Shorted Stat 2nd Stack
29	- Polarity Stat 2nd Stack
30	+ Polarity Stat 2nd Stack
31	Aux In 4
32	Aux In 5
33	Aux In 6
34	Aux Out 1
35	Aux Out 2
36	Aux Out 3
37	Aux Out 4

Pinning connector PCI IF BUS (opt.)

PCI IF BUS		PCI IF BUS	
Pin	Signal	Pin	Signal
1	D0	20	D1
2	D2	21	D3
3	D4	22	D5
4	D6	23	D7
5	A0	24	A1
6	A2	25	A3
7	A4	26	A5
8	A6	27	A7
9	/IOR	28	/IOW
10	RES	29	Not connected
11	Not connected	30	Not connected
12	Not connected	31	Not connected
13	RDY IN	32	RST5.5
14	RTS6.5	33	RST7.5
15	Not connected	34	Not connected
16	Not connected	35	Not connected
17	GND	36	GND
18	GND	37	GND
19	GND		

Functional Description of the DC Control System

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4 Technical Data

Mains Connection, Inputs and Outputs

Mains input		
Voltage	230 V ±10 %	Optional: 115 V
Power	400 VA	
Frequency	50 / 60 Hz	
Fuses	6.3 A	Externally protected with 10 A
Isolation transformer	230 V / 230 V	1.5 kVA
Isolation voltage	4000 V	

Mains output		
Voltage	As for input	
Power	Max. 10 A	Plug connections
Fuses	No internal fusing	

Internal supplies	
+24 V	3.5 A
+15 V	1.2 A
-15 V	1.2 A
+5 V	4 A

Digital Inputs and Outputs

Inputs	24 V	
Outputs	24 V	Protected against shorts

Analogue Inputs and Outputs

Inputs	$0 ... 7\ V_{RMS}$, $-10 ... 10\ V_{P\ (1M\Omega)}$	AC, DC current
Inputs	-200 ... 200 V (60 nF || 20.12 MΩ)	DC voltage
Outputs	-10 ... 10 V	DC
Outputs	+24 V 5.5 W	DC

Safety interlock and Customer-Specific Inputs and Outputs

EMERGENCY off	9 poles male plug	AMP
Safety interlock	4 poles male plug	AMP
Warning lamps	9 poles male plug	AMP
High voltage measurement	BNC socket	
Auxiliary input	9 poles male plug	AMP

Safety interlock circuit

The interlock is the safety circuit that encloses the high-voltage zone. When entering this zone, you must open the safety circuit. The high voltage is automatically cut off when this happens, and the grounding switch (if available) grounds the high-voltage installation. Use suitable connectors and contacts for this purpose. To prevent the control system of interference, use shielded cables only.

Practical example:

GC96 AC

AX 1

1

2

24V DC

3

4

INTERLOCK AX1

Fence   Door   Short Circuit Connector

Shielded Cable

**Connecting the
Safety interlock circuit**
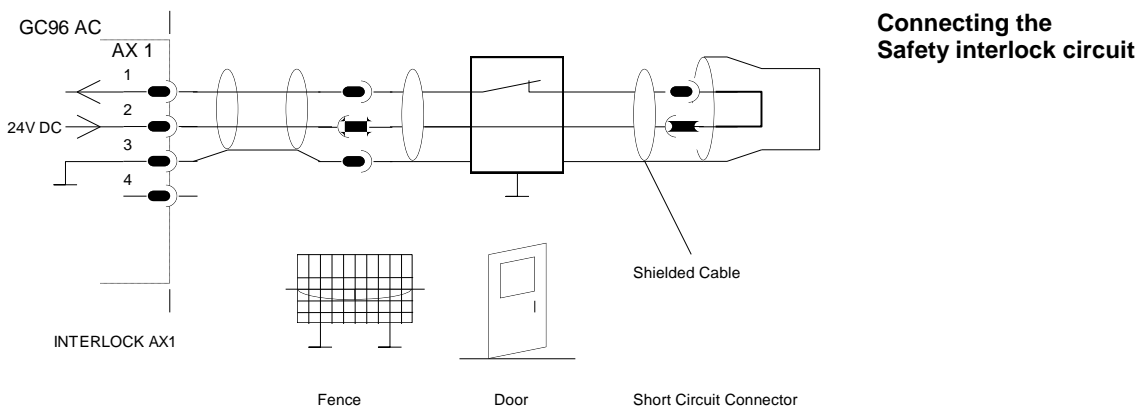
EMERGENCY Off box

The EMERGENCY OFF box is connected to the EMERGENCY socket. Pressing the EMERGENCY OFF button breaks the supply voltage, which disables the high voltage. A safety switch with key lock prevents operation by unauthorized people.

When the EMERGENCY switch is activated, the high voltage circuit is earthed through a built-in safety system. As an additional safety feature, the main supply to the equipment is deactivated. The EMERGENCY circuit operates independent of the control computer.

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Practical example:

GC96 AC

A:X2   EMERGENCY

1
2
3
4
5
6
7
8
9

+24V DC

Emergency Box
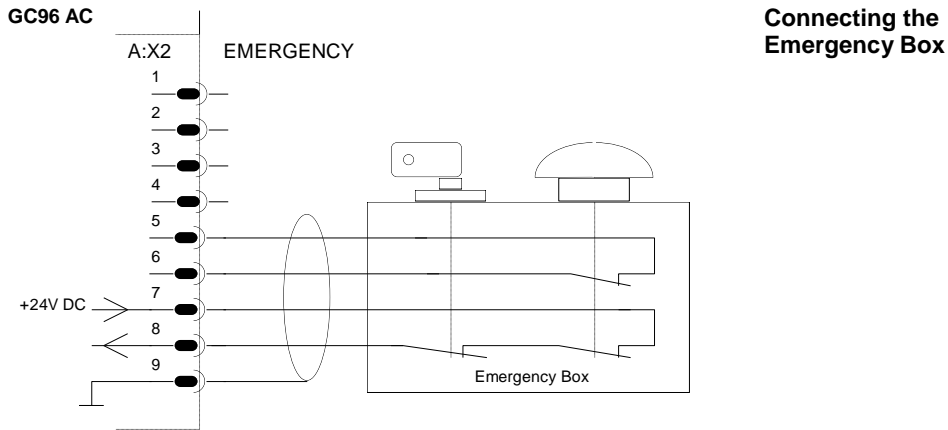
Warning lamps

Relay contacts switch the warning lamp from red to green or off. When the high-voltage installation is turned off, the green lamp is lighted. The warning lamp changes to red when the key switch is turned.

> The warning lamps are externally powered through an isolating transformer. **Shielded cables** must be used. The fusing for the relay contact (3.15 A fuse) must be implemented externally.

Practical example:

GC96 AC

A:X6   WARNING LAMP

Red
Green

Isolating transformer

3.15 A Slow blow

230V

Not included

0R

1
2
3
4
5
6
7
8
9
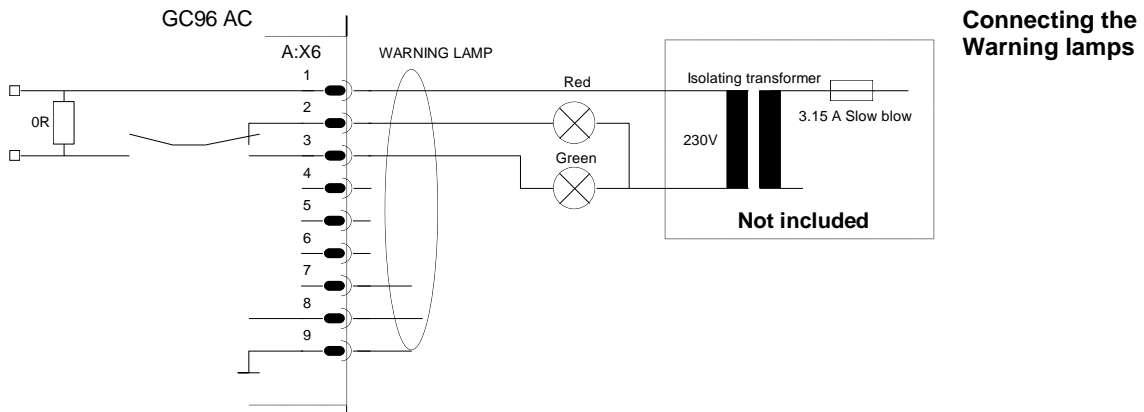
Operating Conditions

Operating temperature	0 ... 40	°C	
Storage temperature	-20 ... +60	°C	
Humidity	20 ... 80	%	Non-condensing
Vibration	3	g	IEC 68-2-6 xyz axis 10-150 Hz
Shock	10	g	IEC 68-2-27 11 ms half sine

Dimensions

Control Rack

Dimensions (L/H/D)	1740 x 1115 x 1120 mm
Working surface height	760 mm
Weight	approx. 250 kg
Transport width	700 mm

Desk (mini rack)

Dimensions (L/H/D)	1170(table)+600(rack) x 760 x 700 mm
Weight	approx. 230 kg

We reserve the right for technical changes without notice.

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5   Instructions

Installing Software on the PCI 811

Extent of Delivery

The control system for your DC system is normally supplied with installed software and the original disks with the software backup.

Using the original disks, you can return to the default condition of the control system at any time.

> ⚠ Store the original disks separately from your installation, preferably in a safe where they are protected against fire, water and magnetic fields.

Installation

You can very easily install the software on the *PCI 811* using the installation program on the original disk, even without computer knowledge. All control setups stored in the *PCI 811* will be written over. Thus if you have created sequences, save them on disk before the installation. Do the same with protocol files.

Perform the following steps for a new installation:

1. Switch on the control desk.

2. Wait until Windows is started up completely.

3. Insert one of the original disks into the CD drive and the installation starts automatically then just follow the instructions. In case the installation should not start automatically you can start it manually by executing the file Install.exe.

Software Options

There are the following software options available:

/SIM   The software will be executed in simulation mode.

Running the Software in Simulation Mode

Most functions of the control system can be simulated in simulation mode. Neither your DC system or the control system is needed for the simulation. This allows operating personnel to be trained in the use of the software, without, e.g., any loading on your test field.

The software must be installed on your PC as explained in the previous section in order to use simulation mode.

The following steps are necessary in order to run the simulation:

1. Click on the Windows Start button and open the menu Execute.

2. Enter **OT257DC /SIM** in the Execute menu and verify with **ENTER** (don't forget the <space> before the /**SIM** extension).

General

The DC system can be operated manually using the Manual Test operating mode, in Automatic Test mode or in Sequence Test mode. All information needed for operation, such as measurements, is summarized into groups, provided in overview in the main window and presented in some cases even as bars.

Input fields/areas can be selected individually with the mouse. Depending on the status and configuration of the DC system, some of the menu points of the function key bar may be hidden and not available, e.g., if the high voltage is switched on. For a better overview of the test, the output voltage is recorded in a graphic window. Additionally test data can be logged to text files.

The active input field often has a mark, the cursor. It indicates the location where the next character that you input on the keyboard will appear. The length of the input field does not limit the number of characters that you can enter into a field. If the number of characters exceeds the length of the input field, the entered string will be scrolled forward character by character.

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System States

Depending on the configuration of the DC system the behavior may be different. The DC system can have the following states:

Power Off:

OT 257 DC Power Off The primary power breaker of the DC system is off. The System Control and 24 V circuitry is energized, the visible ground strap is blocked. The regulator, polarity changer drives are not energized and cannot be operated.

Power On:

OT 257 DC HV Off

The primary power breaker inside the Regulator is now energized. The base is supplied with AC control voltage and the ground strap is controlled by the System Control. If the system was not properly shut down, the DC system will initialize:

- Regulator will drive to minimum position!
- Polarity switch will rotate to Short position! In case of remaining voltage the polarity switch will wait until the voltage decreased to allowed switching level!
- Visible ground strap will be controlled by the System Control! When the Polarity switch is in Short position the visible ground strap will be released!
- The voltage measurement is still active in Power On state, the level will be displayed in dark grey color.

Ready:

OT 257 DC Ready - Waiting for Polarity set

OT 257 DC Ready 58 s

In Ready state the system is ready for HV On:

- Visible ground strap will be removed
- Polarity switch will rotate to desired polarity

During the above operation the frame will be blinking blue/green. Once above conditions are met the system will remain in Ready state as indicated by the timer, the frame will stop blinking. The system can now change to HV On condition. When the state is not changed during this time, the system will show the Alarm HV Failure and return back to Power On state.

HV On:

OT 257 DC HVOn

The secondary power breakers will turn on and High Voltage is on. The system can be operated and is fully functional.

HV Off:

OT 257 DC HV Off

In HV Off state, the system is shut down.

- Regulator will be driven to Minimum position!
- Polarity switch will turn to Short position when the allowed switching level is reached!
- Visible ground strap will be deployed.

The actual (voltage related) status is always shown (by color) and written in the top status bar.

Switching High Voltage on

To switch on High Voltage on the system the following procedure is necessary:

Power F5
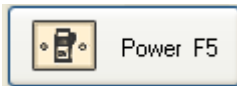
Upon pressing the *Power On* button, the primary power breaker (Q1) is energized providing auxiliary power inside the regulator cabinet and to the base.

As long as the power breaker is not closed, the system shows *Power switch* alarm. This alarm will be reset by itself as soon as the power breaker is closed.

The primary power breaker is not supposed to be switched on and off each time High Voltage is switched on or off. It should be switched on at the beginning of a test session and switched off at the end of it. During the test session it should only be switched off in the case of emergency.

When auxiliary power is available to the system, 2 commands must be issued to the system to turn on High Voltage:

Ready F6
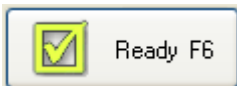
Pressing the *Ready* button will bring the system into Ready state:
- Optional external grounding will be removed
- The internal switch will be rotated from short to the chosen polarity

During this process the title frame is blinking blue and green.

When the system is in Ready state, the title bar will be permanently green displaying a countdown. During this time the button *HV On* must be pressed. When the system times out, HV Failure is displayed and the system returns to Power On state. Button is reached If this action succeeds and the system switches into ready state it indicates this by changing the color of the digits in the output voltage and current display from grey to black. If the system cannot switch to ready state please check the alarms.

HV On F7
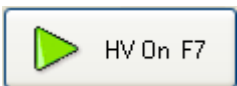
When the system is in ready state High Voltage can be switched on by pressing the *HV On* button. This closes the input and output power breakers (K2) inside the regulator cabinet. The system is now operating in the mode chosen by the operator.

If HV On is not pressed within the count-down, the system displays the alarm HV Failure and will return to Power On state. Before turning the system to Ready state the Alarm must be resetted. This can be done by pressing the Reset Alarm button or by pressing the Ready button.

HV Off F9
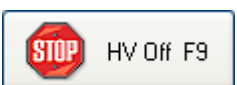
Pressing *the HV Off* button will deactivate the system and return it back to Power On state. The regulator will be moved with maximum speed into minimum position and the secondary power breakers are turned off. The DC voltage will bleed depending on the test object and circuit resistances. When the voltage drops below the allowed switching level the polarity switch will be rotated into short position and then the visible ground strap deployed. During this process the title frame is blinking between red and blue.

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Input Area

Measurement
Test voltage

Top status bar.
Shows the
actual status of
the system

Display and
setting of
voltage trip and
current limit.

Display of DC
ripple (opt)

Display of
Regulator

Trip Values

The system monitors the output voltage and current. The voltage trip level can be set by the buttons or by entering the numeric value. The current limit is defined by the system rating. When a trip level is reached, the system immediately turns into Power On state displaying *Overvoltage* or *Overcurrent* alarm in the HV Section alarms.

The trip value of the *output voltage and current* can be set between 0 % and 110 % of the maximum possible voltage of the set connection level.

Limiter Values

The output current can be limited in *Automatic* mode. This limit will stop the regulator from opening up during the charging process reducing possible overshoot. The regulator will continue with charging when the current drops below the Limit value again.

The limit value of the *output current* can be set between 0A and the maximum possible current of the connection.

Countdown Timer

The test duration can be limited with a timer. The timer can be set to a certain time in seconds, minutes and hours. In Manual Test mode the timer must be started via *Start* pushbutton. In Automatic and Sequence Test mode the timer will start as soon as the system finished the charging and is in stabilized condition. In Manual and Automatic Test mode the system will initiate a HV Off command, when the timer elapses. A timer value of 0 s will be ignored. When the timer elapses, an alarm Time Elapsed will be shown in the System alarms section. The alarm can be reset either with the Reset Alarm button or with the Ready button. At any time the timer can be paused with the *Hold* button. When paused, the time can be changed. The maximum time is 999:59:59.

In Sequence mode the system will continue to the next row, when the timer elapses. A timer value of 0 s will cause the Sequence to continue to the next row directly after reaching the set voltage level. After the last row the system is turned off.

Voltage Control

There are two possibilities to control the voltage, manual or automatic voltage control.

Automatic Voltage Control
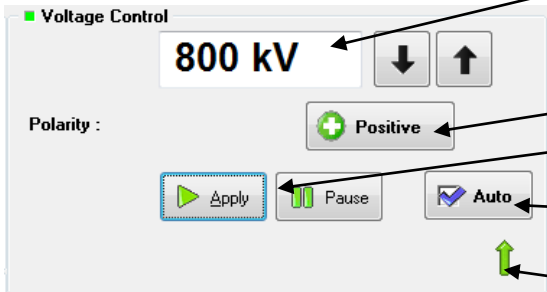
Set Test voltage level.

Voltage level can be adjusted in 50 kV increments using the down and up arrow buttons

See Polarity control.

Changes to the Set Test Voltage level will only become active after pressing *Apply*

Switch between Manual and Automatic Test mode

Status of Regulator
(Minimum, maximum position , moving up, moving down)

Manual Voltage Control

The voltage can be increased/decreased with the *Up* and *Down* button. The rise speed can be set in % of the regulator speed in the Tab Sheet RegContr. When *Fast* is activated, the setting for High Speed will be applied, else Low Speed.

Polarity Control

The polarity can be changed any time using the polarity selector. When the system is in HV On State, a safety dialog will be presented to prevent accidental polarity changes. The following actions will be performed:

- HV Off command:
  Regulator driven to minimum position
  Secondary power breakers opened
  When voltage below allowed switch level internal switch will be rotated into short

- The system will remain in short as defined in the Tab Sheet System Info Section Polarity Changing / Time in shorted position.

- The polarity switch will be changed to the desired polarity

- The secondary power breakers are closed

- The system is ready for High Voltage. The operator can set the desired test value again

Disable Grounding Key Lock

An optional Grounding Key Lock Box is available. This Box will interrupt the command line to the polarity changer motor and prevent the system from accidental operation. This box has been especially requested for routine testing of long cables.

When the box is activated, the Polarity selector button will be disabled and the following information displayed:

As per design, an operation of the polarity switch is not possible. For grounding the system or changing the polarity the key lock must be unlocked.

Tab Sheet Alarms

Alarm signals and system status are shown in the tab sheet Alarms. If the *Ready State* cannot be reached, this may be due to an alarm. Some of the alarms can be reset by the *Ready* or *Reset Alarms* button, more severe alarms only by *Reset Alarms*. The status signals indicate the state of the system. They are automatically reset when the associated fault is eliminated, for example Interlock or Emergency.

If an alarm occurs during operation of the system the HV is shut off. Depending on the severances of the failure there are 3 shut off procedures:

1. Regulator is driven down to minimum position
    HV relays including secondary power breakers is opened

2. HV relays including secondary power breaker is opened

3. Primary power switch is opened

The difference in the 3 procedures is the electrical stress on the power breakers, with the 1st procedure being the least demanding (load less switching). Driving down the regulator to minimum position may take some time and is therefore not possible for the more critical alarms.

In all cases the system is not shut down completely. It is within the responsibility of the operator to return the system to a safe condition.

System Alarms
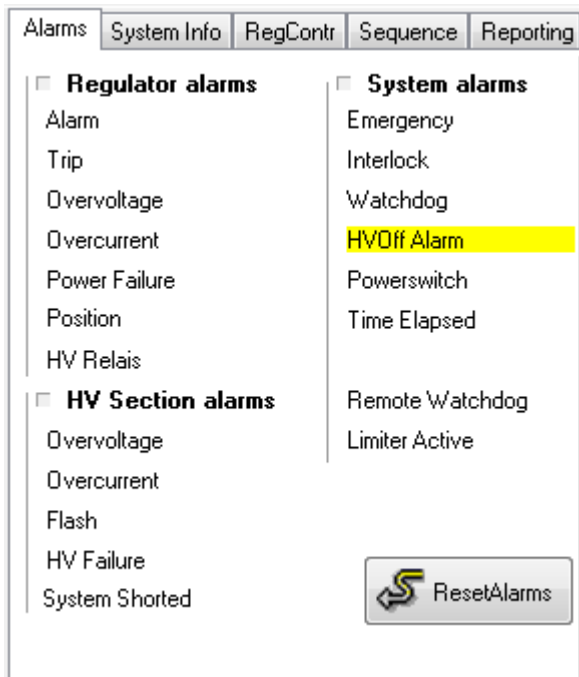
Emergency

This signal is active as long as one or more emergency buttons are pressed. The main switch of the system is switched off. The missing supply voltage can initiate other error signals. All emergency switches of the system must be deactivated before the system can be started up.

Interlock (Safety interlock)

This signal indicates an open interlock connection. The interlock connection loop must be closed to be able to switch on the high voltage.

Watchdog

This signal indicates a software or time-out error between controller and DIFa-DTC. The control system switches the high voltage off and sets the alarm signal to red. .

HV Off Alarm

There is a collected alarm inside the DIFa-DTC interface which can be set by any card (PCB) of this device. If this alarm does not reset, please contact the supplier.

Power switch

Shows the status of the primary power switch. This item shows yellow when the main power switch is not closed either after starting up or after the emergency stop was activated.

Time Elapsed

The timer was started and has reached its time-out value. This signal indicates that the timer has carried out its function and that the control system has switched off the high voltage in the prescribed manner.

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Ground Switch

If a Ground switch is installed and activated here will be shown if there is an error detected.

Remote Watchdog

If the communication timeout between the PC and the OT257 Interface gets too big this alarm will be shown.

Limiter Active

When the current limiter is active this alarm will be shown, it will automatically go off when the current is below the limit.

Regulator Alarms

Alarm

This alarm is activated by an optional temperature sensor if the programmed maximum temperature (trip) of the regulating transformer is exceeded. In case of over temperature the regulator is brought down to minimum value and then switched off.

Trip

This alarm is activated by an optional sensor (Buchholz relay), the high voltage is immediately switched off. This is caused by gas in the regulation transformer resulting from heat or flashover.

Overvoltage

The regulation transformer voltage exceeded the *trip value.*

Overcurrent

The regulation transformer current exceeded the *trip value.*

Power Failure

Power failure is activated if the power switch is not switched on following a command from the control system.

Position

The *Position* alarm will show when high voltage is off and the regulator is not in minimum position this alarm cannot be reset by software, it will reset itself as soon as the minimum position is reached.

HV Relays

If the high voltage is switched off by the control system but the high voltage relay still signals high voltage.

HV Section Alarms

Overvoltage

The high voltage has exceeded the *trip value*.

Overcurrent

The output current exceeded the *trip value.*

Flash

When the measurement card detects a voltage drop from the actual measured value to the rolling average by more than the allowed *Voltage Drop Level*, the secondary power switch/HV relays is opened and the flash alarm displayed. The alarm shows the last DC value before the flash.

During shut down procedure the flash detection is deactivated. The regulator is being driven down and the secondary power breakers opened, therefore a detected flash would not cause a difference in the system behavior. Additionally, during the operation of the internal switch there will be a switching arc, which is not a fault arc at the test object. In case of unfortunate values for **UserPolMaxLevel** and **UserFlashMaxLevel** this could create false alarms, which would be disrupting polarity reversal testing. The flash detection is deactivated during shut down of the system to prevent false alarms due to the switching arc.

HV Failure

This alarm occurs when the *Ready* button is pressed but the system timer elapses before *HV On* is pressed.

System Shorted

Here the actual Status of the polarity switch will be shown.

Tab sheet: System Info

In this menu some system related information can be found and set.

Connection

The connection must be chosen according to the system setup. This value cannot be changed in HV On state. Trips and limit values as well as scale factors are set accordingly. Operating the system in a different configuration then the set connection may cause damage to the system and/or test object.

Flash Detection

The measurement card compares the current voltage measurement against a smoothed DC value. If the difference between both values is higher than the allowed *Voltage Drop Level*, a flash alarm is generated. The secondary power breakers and HV relays are hardwired and instantaneously opened. The flash alarm indicates the last DC voltage level. The Voltage Drop Level can be set inside the Calibration menu.

The Flash detection also can be disabled, so the system does not switch off in the case of an Flash.

Polarity Changing

During a polarity reversal, the internal switch rotates into short position. *Time in shorted position* defines the time the switch remains in shorted position. This value can be set depending on customer preferences.

Language

If available, the software can be switched to different language versions.

About

Shows the current version of the software.

HT Setup

Haefely Hipotronics Setup for configuration of the DC system, not for Customer configuration.

Calibration

Password protected customer accessible setup menu to access specific parameters.

Calibration menu

The measured values, regulator voltage, regulator current, HV DC voltage, HV DC current are transduced to a lower voltage signal, 0 - 10 Vpp AC for regulator values, ± 10 V DC for HV DC current and ± 200 V DC for HV DC voltage. The control software recalculates the actual value by multiplying the measured value with the scale factor. The scale factors are set initially during the commissioning procedure. The scale factors for regulator and HV DC current typically do not change with different connections. The scale factor for the HV divider however is affected with different configurations of the system setup.

IEC 60060-2 ed. 3.0 2010 recommends the repetition for calibration (Performance Test) to annually, but at least every 5 years. However if any changes are done to one of the transducing devices, that device shall be recalibrated.

For security the calibration dialog is protected by a password.

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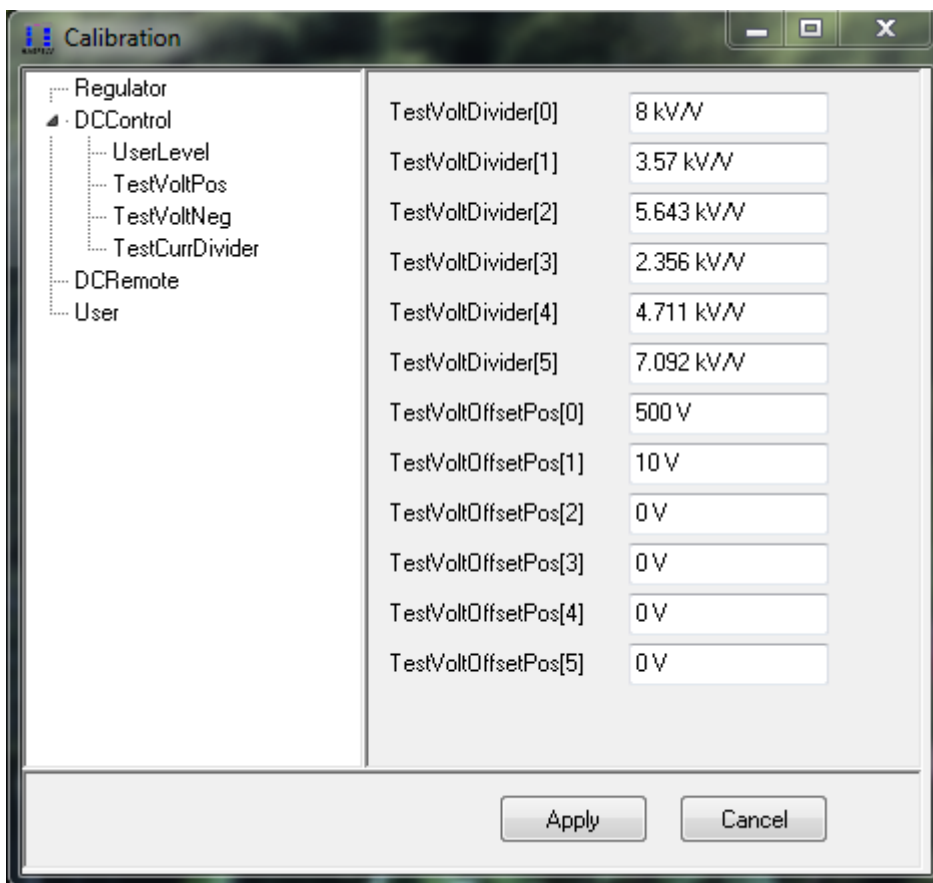
Calibration procedure

This manual cannot describe the complete calibration procedure according to IEC 60060-2 ed. 3.0 2010. An IEC conform calibration will result in a new scale factor which must be entered in the appropriate **TestVoltDivider** section in the Calibration menu under DCControl. TestVoltDivider[0] belongs to the top entry in the Connection dialog.

For the voltage the positive and negative polarity need to be calibrated this can be done in the **TestVoltPos** and **TestVoltNeg** section. In each section for all 6 connections a Divider and a Offset value can be defined. If an System shall be upgraded to a new software version with this offset values and the calibration will not be done at the same time all of this offset values need to be set to 3323.925V else the calibration is invalid.

The scale factor of the HV DC current measurement **TestCurrDivider** can be differentiated for the different connections. However changing the number of DC modules connected in series does not affect the scale factor for the HV DC current measurement, therefore the scale factor will be typically identical for all connections.

Regulator voltage **Voltage.FullScale** and current **Current.FullScale** is regulator specific and will not change due to reconfigurations on the HV side.

For a new calibration an external measuring device to measure the calibration value is needed. (A calibrated voltage divider with a voltage measuring unit or a calibrated current measuring unit or something equivalent). The procedure is basically identical for **Regulator Voltage, Regulator Current, HV DC Voltage, HV DC Current**.

Perform a measurement at the desired calibration value. This will result in a „Measured Value" with the reference device and a value from the OT257DC controller. The old scale factor will be taken from the Calibration Menu.

The new scale factor can then be calculated:

$$New\_Factor = \frac{Old\_Factor * Measured\_Value}{OT257\_Value}$$

The old scale factor must be overwritten with the new value...
After a successful re-calibration - Save the new setup!

> *A wrong calibration results in a wrong measurement of the corresponding value. This can cause serious damage to the HV DC Generator and / or the test object.*

Calibration menu: Regulator

Voltage.FullScale	Scale factor for regulator voltage
Current.FullScale	Scale factor for regulator current

Calibration menu: DCControl_UserLevel

These settings are optional

UserPolMaxLevel	Value in % of system rating. Voltage level at which the system will issue the driving command for the internal switch. Higher values will shorten the polarity reversal time at the cost of stronger switching arcing inside the module. Lower values recommended (2% to 5% typically)
UserFlashMaxLevel	Value in % of current voltage level. A voltage drop of the current voltage value against the rolling averaged HV DC voltage above **UserFlashMaxLevel** will issue a Flash alarm.

Calibration menu: DCControl_TestVoltPos

TestVoltDivider[0]	Scale factor for positive voltage measurement for top HV DC system connection
.	
.	
TestVoltDivider[5]	

TestVoltOffsetPos[0]   Offset Value for positive voltage measurement for top HV DC system connection

.

.

TestVoltOffsetPos [5]

Calibration menu: DCControl_TestVoltNeg

TestVoltDividerNeg[0]   Scale factor for negative voltage measurement for top HV DC system connection

.

.

TestVoltDividerNeg[5]

TestVoltOffsetNeg[0]   Offset Value for negative voltage measurement for top HV DC system connection

.

.

TestVoltOffsetNeg[5]

Calibration menu: DCControl_TestCurrDivider

TestCurrDivider[0]   Scale factor for current measurement for top HV DC system connection

.

.

TestCurrDivider[5]

Calibration menu: DC Remote

Enabled   Enabling/disabling of remote operation

LAN Port   Port at which the OT257DC is accessible for remote control. Standard value: 1024

    The IP address must be specified by the customer and should be from a different IP address range than the OT257DC and DIFa-DTC (192.168.0.200). For example 192.168.1.100:1024

RENPW   Password for remote access

Calibration menu: User

CustomerPWD   Customer Password to enter "Calibration Menu"

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Tab sheets: RegContr

High Speed:	40 %
Low Speed:	20 %
Pulse Speed:	50 %
LowRamp Level:	70 %
Puls Level:	90 %
PulseOnTime:	4.0 s
PulseOffTime:	2.0 s
StabRange:	1.2 %
Limiter Output Current:	10.00 mA

Since Software Version 3.0 significant changes were done to the voltage regulation in Automatic and Sequence mode. This change was necessary due to the wide range of different loads associated especially with cable testing. Time constants for the system can vary from < 1 s to > 11000 s with different requirements on the regulation parameters. The diagram shows the influence of the single parameters found in the Tab sheet RegContr.
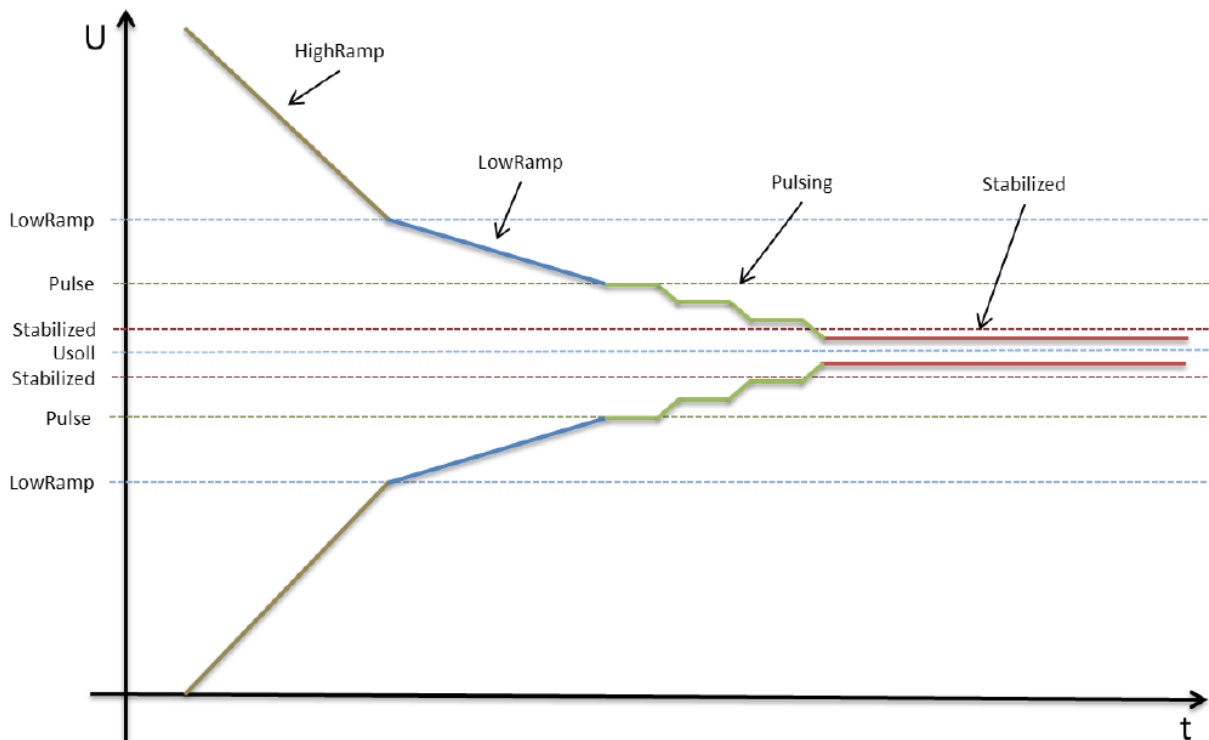
The regulation diagram shows a symmetric charging and discharging. In reality, charging and discharging will be highly asymmetric as the charging can be done with significantly higher currents then the discharging.

The values for HighRamp and LowRamp will be used in Manual mode for the fast and slow voltage rise.

With all parameters available to the customer, the regulation can be adjusted for each test object to achieve the fastest charging while avoiding any overshoot.

The regulation algorithm is supporting the new current limit. When the voltage is increased too fast, the current will increase to charge up the load. When the current reaches the limit value, the regulator will pause and wait for the current to drop down below the limit value again. This will help prevent overshooting especially on lower test voltage levels as the regulator will not open up to far and allow the cable load to charge up.

The diagram shows the regulation for symmetrical load (time constant is very small). Large loads (long cable, etc.) will have high time constants which will make decrease of the voltage slower.

High Speed

Speed for the regulator until Low Ramp Level reached. Value is % of max. Regulator speed.

Low Speed

Speed for the regulator between Low Ramp Level and Pulse Level. Value is % of max. Regulator speed.

Pulse Speed

Speed for the regulator between Pulse Level and Stab Range. Value is % of max. Regulator speed

Low Ramp Level

Voltage level when the regulator changes from High Speed to Low Speed setting. Value is % of test voltage level. Value is symmetric.

Pulse Level

Voltage level when the regulator changes from Low Speed to Pulse Speed setting. Value is % of test voltage level. Value is symmetric.

Pulse On Time

Time during which the generator will be pulsed until the test voltage level is reached. Value is in seconds.

Pulse Off Time

Time during which the generator will be paused so that the voltage at the test object can pick up. Value is in seconds.

Stab Range

Allowed deviation from the test voltage level. Value is in % of test voltage level. Value is symmetric.

Limiter Output Current

Here the limit value for the output current can be defined. As soon the measured output current is higher than this value the regulator will stop, until the measured value is again below this value.

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Tab sheets: Sequence

Current row is marked blue

Define voltage levels, duration and comments

Comment line can be used for cycling/cascading

Control buttons:
Start, Start At, Stop

Counter when cycling

In Sequence mode, voltage levels and duration can be defined which are executed in sequence. The voltage regulation will be done with the regulation parameters as defined in Tab sheet **RegContr** and current limit. These can be changed at any time during the sequence. Voltage levels and duration inside the sequence must be defined prior to the execution of the sequence and cannot be adjusted during operation.

A right-click in the Sequence Tab sheet will bring up the following menu:

 Delete Row: Marked row will be deleted

 Insert Row: A new row will be inserted at the current position, existing rows will be moved down

 Load Sequence: Allows to load a previously saved sequence

 Save Sequence: Allows to save a sequence for future use

When the system is in Power On or Ready state, the sequence can be executed by pressing *Start* or *Start At* button. A dialog box will pop up informing on the maximum voltage levels during the sequence. By accepting, the system will automatically turn to HV On state. With *Start* the sequence will be started at row 1, with *Start At* the sequence will be started at the highlighted row. *Stop* will abort the sequence and return the system to Ready state.

The maximum duration is 20:00:00, in case of longer tests the time must be distributed across multiple rows.

With the command "#goto=<row> (for <times>)" cycling / cascading can be done. If the goto command is entered with the extension "for <times>" it will be repeated for as many times as specified. After the last cycle, the sequence will continue to the next row and the counter reset. A counter will show when cycling. The goto command can be used multiple times. With multiple usage, the counter will only show the counting for the first loop correctly.

For example:

Nr	Voltage	Time	Comment
1	-500 kV	01:30:00	
2	+500 kV	00:45:00	#goto=2 for 3
3	-500 kV	00:45:00	#goto=1

The system will perform the test in the following order:

Row 1; 2; 2; 2; 3; 1; 2; 2; 2; 3; Finish

Any alarms will be handled exactly the same as in Manual or Automatic Mode.

Tab sheets: Reporting

In the tab sheet Reporting all parameters can be defined to automatically generate a log file of the test. The log file is saved as a text file (*.csv or *.txt), and can be imported into "MS Excel" or any similar program.

Reporting Active	Activates Reporting when high voltage is on
Delete After Startup	Each time, when the software is started, the report file will be deleted.
Report File	The actual report file, where all measurement data is stored. Possible extensions are *.csv or *.txt
Report Interval	The interval of reporting in seconds. The number behind the edit field shows the remaining time until the next value will be written to the report file.
Separator	The delimiter between the values. Per definition *.CSV is comma separated values. However depending on the regional settings of the operating system, a different delimiter may be more convenient.
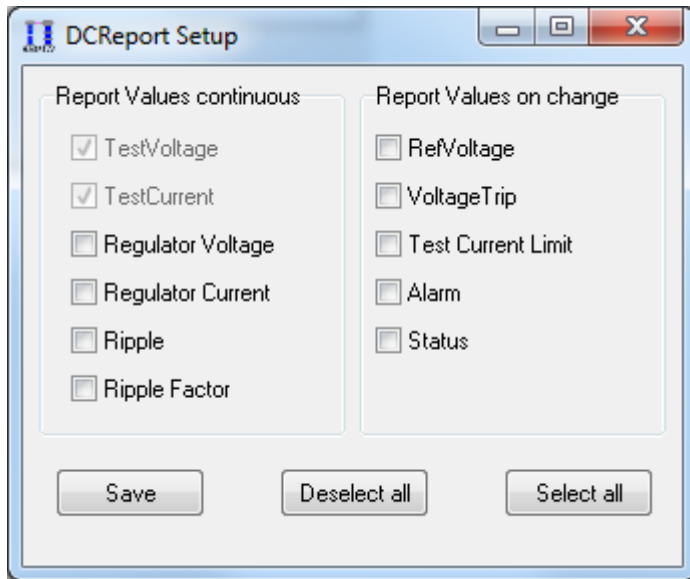
Setup allows to define the saved parameters. Test Voltage and Test Current are mandatory, for troubleshooting additional values may be helpful.

Record Now adds a line with actual measurements and settings to the report file

Show Report opens the selected report file in the program associated with the extension *.csv, typically "MS Excel".

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Date	Time	TestVoltage[V]	TestCurrent[A]	RegulatorVoltage[V]	RegulatorCurrent[A]	Timer	SetVoltage[V]	SetRiseSpeed[V/s]	TestVoltageTrip[V]	TestCurrentTrip[A]	Alarm	Status
2	01.09.2011	12:00:38	0	0	0	0	00:00:00	500000	40000	1300000	0.02		Ready
3	01.09.2011	12:00:40	0	0	0	0	00:00:00	500000	40000	1300000	0.02		Ready
4	01.09.2011	12:00:41	0	0	0	0	00:00:00	500000	40000	1300000	0.02		HVOn
5	01.09.2011	12:00:46	-193269.09	0	177.16	9.66	00:00:05	1000000	40000	1300000	0.02		HVOn
6	01.09.2011	12:01:00	-771989.09	-0.01	707.66	38.6	00:00:05	1000000	40000	1300000	0.02		HVOn
7	01.09.2011	12:01:06	-950749.09	-0.02	871.52	47.54	00:00:05	1000000	40000	1300000	0.02		HVOn
8	01.09.2011	12:01:11	-986832.61	-0.02	904.6	49.34	00:00:05	1000000	40000	1300000	0.02		HVOn
9	01.09.2011	12:01:17	-990145.57	-0.02	907.63	49.51	00:00:01	1000000	40000	1300000	0.02		HVOn
10	01.09.2011	12:01:22	-874110.37	-0.01	801.27	43.71	00:00:01	0	40000	1300000	0.02		HVOn

Figure 1 : Report in "MS Excel" 1

Remote Option

Using the remote control option, you can fully operate the OT257DC by remote control via Windows socket on the LAN (local area network) interface.

This section first describes the basic characteristics of the built-in interfaces, the command syntax and the data format. Then detailed information is given about the registers and commands made available for remotely controlling the OT257DC.

Command Syntax

The command syntax corresponds to that of the IEEE 488.2 standards. The following is an explanation of the terms, special characters and rules of syntax.

Terms, Characters	Explanation	Example
<EOS>	End character, sent as conclusion of a transmissions or serves to recognize the end of a transmission	Depends on the interface settings
Command header	Specifies the command to be executed.	
Argument	Contains the value to be input; can be transferred in various formats (also see the "Data Format" section.	
<SPACE>	Separates the command header from the argument.	
Command	Command header and argument together.	
:	Separates command headers from one another.	
,	Separates arguments from one another.	
?	Attached to the command header for interrogating an argument	
;	Separates individual commands from one another.	
Command sequence	Several commands one after another.	
' or "	Marks the beginning and the end of a string argument.	
'' or ""	Immediate repetition of the ' or " character in a string argument. Accepts the character in the string without the argument being taken as closed.	

The OT257DC can process command sequences, whereby only one query is allowed per sequence which must be positioned at the end of the sequence.

You can transmit upper and lower case letters when transmitting command headers and arguments.

Data Format

All numerical input and outputs are in SI units (volts, amperes, ohms, V/V etc.). The following summary shows the formats used:

Format	Description	Examples
<NR1>	Whole numbers	1, -8
<NR2>	Real numbers	1.4, -3.64
<NR3>	Real numbers with exponents	1.56E+1, -1.67E-12
<String>	Character sequences without CR (ASCII 13)d LF (ASCII 10). Also see the "Command Syntax" section	'Test character sequence'
<ARBITRARY ASCII RESPONSE DATA>	Character sequences of indefinite length, closed by the end character.	abcdefg.......zzzzzz and even more<EOS>

			L S	L A	R S	R A	Commentary.
<DEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>							Data byte sequence with definite length, closed with the end character	#10 0123456789<EOS>

Command Set

The commands available for remotely controlling the OT257DC are summarized in the following sections.

Most of the commands have a short form and a long form. These are made clear by the selection of upper or lower case letters. The part of the command header written in upper case has to be transmitted so that the OT257DC can recognize the command. The part of the command written in lower case letters can also be transmitted, but need not be. It serves to enhance understanding.

In general, queries can take place locally. However, most of the set operations have to be carried out using remote control operation.

The command tables give information about the allowable operations. An 'x' marked in a column means:

LS   setting or executing is allowed in local state operation,
LA   querying in local state operation is allowed,
RS   setting or executing in remote control operation is allowed,
RA   querying in remote control operation is allowed.

General Commands

This section describes the "common commands" defined in the IEEE 488 standard as well as register queries and miscellaneous memory and loading commands.

			L S	L A	R S	R A	Commentary.
*IDN?	<ARBITRARY ASCII RESPONSE DATA>			x		x	Return of device identification in the format: <Companyname>, <Model>, 0, <Software-Version>, i.e., HAEFELY TEST AG, OT257DC, 0, X.XX
*TST?	<NR1>			x		x	OT257DC returns a '1' for unavailable or defective hardware, otherwise a '0'
*OPC?	<NR1>			x		x	If all pending operations have been carried out, then the answered returned is ASCII 31 ('1'). The OT257DC always returns a '1' because all commands are processed strictly one after another.
*OPC			x		x		Sets the OPC bit in the ESR status register to True. Has no further effect on the OT257DC
*CLS			x		x		Clears all registers
*STB?	<NR1>			x		x	Calls up and then deletes, with exception of the MAV bit, the contents of the status register masked by the service request enable.
*SRE	<NR1>				x		Sets the Service Request Enable Register and determines which events initiate an RQS/MSS when using the interface.

Command	Parameter	LA	RA	LS	RHE	RHA	Description
*SRE?	<NR1>		x		x		Returns the contents of the Service Request Enable Register.
*ESR?	<NR1>		x		x		Returns and then clears the contents of the Event Status Register.
ISR?	<NR1>		x		x		Returns and then clears the contents of the Internal Status Register
ISE	<NR1>			x			Sets the Internal Status Enable Register and determines which internal sequence should initiate a collective error.
ISE?	<NR1>		x		x		Returns the contents of the internal Status Enable Register.
CMR?	<NR1>		x		x		Returns and then clears the contents of the Command Error Register.
EXR?	<NR1>		x		x		Returns and then clears the contents of the Execution Error Register.
DDR?	<NR1>		x		x		Returns and then clears the contents of the Device Dependent Register.
QYR?	<NR1>		x		x		Returns and then clears the contents of the Query Error Register.
REN	Password	x		x			Switchover to remote control. If the remote password is defined it must be sent with this command. F.e REN "PWD". The Password can be set in "System Info: Calibration"
GTL		x		x			Switchover automatic control.
SET?	<ARBITRARY ASCII RESPONSE DATA>		x		x		Returns the current settings of the OT257.
HELP?	<ARBITRARY ASCII RESPONSE DATA>		x		x		Returns the available command headers.

Commands for Controlling the System

There are commands that can be activated only for a switched on or switched off high voltage. The RHE (Remote High Voltage ON) and RHA (Remote HV OFF) columns give information about the necessary states of the system. If a command is executed in an incorrect state, bit 0 in the DDR Register is set.

Remark:

LA = Local Answer

RA = Remote Answer

LS = Local Set

RHE = Remote HV ON Set   RHA = Remote HV OFF Set

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Command header 1	Command header 2 or Arg.	Command header 3 or Argument	Arg.	LA	RA	LS	RHE	RHA	Commentary
HV HV?	OFF ON READY			x	x		x x x	x x x	Switches the high voltage on or off. Before switching on the system, the power switch must be switched on. In order to switch on the high voltage, the system must be in the READY state. The READY state may not last more than 5 seconds, otherwise the High Voltage Missing alarm is initiated. You can interrogate the state of the alarm with 'HV?' .
POWER POWER?	OFF ON			x	x		x	x	Switches the power switch on or off.
REFVoltage REFVoltage?	<Nx>			x	x		x	x	Sets or returns the target value of the voltage.
AUTO	VOLTage	OFF ON		x	x		x		Switches the automatic voltage selection on or off.
	SPeeD	VALue VALue?	<nr1>	x	x		x	x	Sets the voltage speed of the automatic voltage selection.
STABilized?	NO YES			x	x				Voltage state. Indicates whether the voltage specified by REFVoltage has stabilized. AUTO:VOLT must be switched on.
POLarity POLarity?		POS NEG SHORTED CHANGING		x	x		x		Sets or returns the actual polarity. For the command only "POS" and "NEG" are available.
REGulator	MOTor MOTor?	Stop Inc Dec		x	x		x	x	Sets or indicates the actual state of the regulator drive. Up increases the voltage, down decreases the voltage and stop stops the drive.
	MANspeed	Low High		x	x		x	x	Sets the speed for the operation of the regulator drive to low or high
	POSition?	Min Mid Max		x	x		x	x	Returns the actual position of the regulator drive. Mid means an illegal position has been reached. Min: The regulator is in minimum position. Max: The regulator is in maximum position.
TIMer	TIME TIME?	<N1>, <N1>, <N1>		x	x		x	x	Sets or returns the timer setting in the format <Hours>,<Minutes>, < Seconds>. Call TIMER
	STATus STATus?	OFF ON		x	x		x	x	Activates or deactivates Timer. The Timer automatically starts counting down upon reaching the voltage. It can be stopped with this command or restarted.
SERNR?				x	x				Serial Number of Device
HVConnection	LaBeL?			x	x				actual set High Voltage Connection

Trips and Measurements

All values are in IS units ([A][V], etc.)

Command header1	Command header f2 or Arg.	Command header f3 or Argument	Arg	LS	LA	RS	RA	Commentary
OUTput	VOLTage	DC?	<Nx>		x		x	Current DC value of the output voltage
		Ripple?	<Nx>		x		x	Current ripple value of the output voltage (optional)
		LIMIT LIMIT?	<Nx>		x	x	x	Sets or returns the current limit value for the DC voltage.
	CURRent	VALue?	<Nx>		x		x	Current output current
		LIMIT LIMIT?			x		x	Output current trip
FLASH	VALue?	<Nx>			x		x	Last measured value for a flashover. If no flashover has occurred, a 0 is returned.
REGulator	VOLTage?	VALue?	<Nx>		x		x	Regulating transformer voltage
	CURRent?	VALue?	<Nx>		x		x	Regulating transformer current

Alarms

Command header1	Command header2 or Arg.	Command header3 or Argument	LS	LA	RS	RA	Commentary
ALarMs	RESet				x		Deletes all existing alarms if this is possible.
	EMerGencY?	NO YES		x		x	Emergency off button is pressed [YES], or not pressed [NO].
	INterLocK?	NO YES		x		x	Safety interlock is open[YES], or closed [NO].
	RegVoltTRIP?	NO YES		x		x	Voltage trip for regulating transformer [YES]
	RegCurrTRIP?	NO YES		x		x	Current trip for regulating transformer [YES]
	PoWeRFAIL?	NO YES		x		x	Power switch cannot be switched on. Power is not connected.

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				x		x	
	HVFAIL?	NO YES		x		x	High voltage missing. The time between the state READY and the state HVON may not be longer than 5 seconds.
	REGPOSition?	NO YES		x		x	The regulating transformer has not yet reached the minimum position. Switch on is not possible.
	OutVoltTRIP?	NO YES		x		x	Output voltage trip
	OutCurrTRIP?	NO YES		x		x	Output current trip
	TIMer?	NO YES		x		x	Automatic timer has expired.
	FLASH?	NO YES		x		x	A flashover has occurred.
	IFSalarm	NO YES		x		x	Communication between PCI and DIF broke down.
	REGAlarm	NO YES		x		x	A hardware alarm in the regulator occurred,
	REGTRip	NO YES		x		x	A hardware trip in the regulator occurred,
	HVALarm	NO YES		x		x	A hardware alarm in the HV section occurred,
	IFSalarm	\<Nr1\>		x		x	Bit coded integer value carrying following alarms. Bit 0 IF collective alarm Bit 1 Communication between PCI and DIF broke down Bit 2 Emergency button pressed Bit 3 Interlock is open
	REGS~ection	\<Nr1\>		x		x	Bit coded integer value carrying following alarms. Bit 0 Regulator collective alarm Bit 1 Alarm Bit 2 Trip Bit 3 Voltage trip Bit 4 Current trip Bit 5 Power missing Bit 6 Regulating transformer position
	HVS~ection	\<Nr1\>		x		x	Bit coded integer value carrying following alarms. Bit 0 High voltage collective alarm Bit 1 Alarm Bit 2 Voltage trip Bit 3 Current trip Bit 4 High voltage missing Bit 5 Timer Bit 6 Flashover

6 Dangers and Safety Notes (English)

General Notes

In general, a high voltage system is a large danger source for accidents. Thus please observe the following notes and safety regulations.

> The AC Control System may only be operated by **trained** personnel.

> The high voltage can only be switched on if all safety requirements are fulfilled. Thus no safety devices of the system or the control desk are to be bridged.

> The safety interlock is not to be shorted under any circumstances. The safety interlock must be led around the system and any entry to the system should open the safety interlock (e.g., connecting into door contacts, etc.).

Dangers when Working on the Control Desk

The desk / rack of the AC Control System is a unit enclosed within itself, that normally hides no dangers from the user. The following points must nevertheless be observed:

> The control system may only be used in a high voltage system if the earthing bolt at the rear of the control desk is connected to the earth of the entire system.

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The mains lines of the control desk are no longer covered following dismantling of the rear or front plates. Thus the mains connection for the control system must be removed before carrying out any dismantling work. The voltage feed lines are inside the desk and the individual devices no longer specially marked.

Since the high voltage can normally be switched on only from the control desk, the user of the control system is thus responsible that no personnel are within the safety screening.

Safety Precautions when Working with High Voltage

Owing to safety considerations, all work within the high voltage area should always be supervised by a second person. Installation and operating personnel must know the procedures following a high voltage accident.

All emergency off switches must always be accessible. One of the switches must be fixed on the control desk. This switch is supplied and can be magnetically fastened to the desk.

The safety interlock should only be opened after the high voltage has been switched off.

The safety interlock and safety screening must never be surmounted.

Dangers of the High Voltage System

High voltage components, in particular capacitors, can be electrically charged even if the high voltage is switched off. These components must thus be discharged with an earth rod without fail whenever anyone enters the high voltage area. The tools required for this (e.g., earth rod) must always be available in the system.

The grounding rod must be connected to the system earth. The grounding cable may not be touched or stepped on during the discharge.

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7 Gefahren- und Sicherheitshinweise (German)

Allgemeine Hinweise

Eine Hochspannungsanlage ist im Allgemeinen eine grosse Gefahrenquelle für Unfälle. Darum beachten Sie die nachfolgenden Hinweise und Sicherheitsvorschriften.

> Die Steuerung OT257 DC darf nur von **geschultem** Personal bedient werden.

> Die Hochspannung kann nur eingeschaltet werden, wenn alle Sicherheitsbedingungen erfüllt sind. Darum dürfen keine Sicherheitsvorrichtungen der Anlage und/oder der Steuerung überbrückt werden.

> Der Sicherheitskreis darf unter keinen Umständen kurzgeschlossen werden. Der Sicherheitskreis muss um die Anlage herumgeführt sein. Jegliches Betreten der Anlage sollte den Sicherkreis öffnen. (z.B. Einschleifen in Türkontakte usw.).

Gefahren beim Arbeiten am Steuerpult

Das Pult / Rack der Steuerung *OT257 DC* ist eine in sich geschlossene Einheit, die normalerweise für den Anwender keine Gefahren birgt. Folgende Punkte müssen jedoch beachtet werden:

> Die Steuerung darf nur in einem Hochspannungsprüfsystem verwendet werden, wenn die Erdschraube auf der Rückseite des Steuerpultes mit der Erdung der gesamten Anlage verbunden ist.

⚠️ Beim Steuerpult sind die Netzleitungen nach der Demontage von Rück- oder Frontplatten nicht mehr abgedeckt. Darum muss vor allen Demontagearbeiten der Netzanschluss der Steuerung entfernt werden. Die spannungsführenden Leitungen sind im Innern des Pultes und der einzelnen Geräte nicht mehr speziell gekennzeichnet.

⚠️ Da die Hochspannung normalerweise nur über das Steuerpult eingeschaltet werden kann, ist der Anwender der Steuerung dafür verantwortlich, dass sich beim Einschalten der Hochspannung kein Personal mehr innerhalb der Sicherheitsabsperrung befindet.

Sicherheitsvorkehrungen beim Arbeiten mit Hochspannung

⚠️ Aus Sicherheitsgründen sollten Arbeiten innerhalb des Hochspannungsbereichs immer durch eine zweite Person überwacht werden. Das Montage und Bedienungspersonal muss die Verhaltensregeln für Hochspannungsunfälle kennen.

⚠️ Alle Notausschalter müssen immer zugänglich sein, wobei einer der Schalter am Steuerpult befestigt sein muss. Dieser Schalter wird mitgeliefert und haftet magnetisch am Pult.

⚠️ Der Sicherheitskreis soll nur bei ausgeschalteter Hochspannung geöffnet werden.

⚠️ Der Sicherheitskreis und Absperrungen dürfen nicht überstiegen werden.

Gefahren- und Sicherheitshinweise (German)

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Gefahren der Hochspannungsanlage

Bauelemente für Hochspannung, im speziellen Kondensatoren, können auch bei ausgeschalteter Hochspannung elektrisch geladen sein. Darum müssen sie bei jedem Betreten des Hochspannungsbereichs unbedingt mit der Erdstange entladen werden. Die dafür notwendigen Hilfsmittel (z.B. die Erdstange) müssen immer bei der Anlage deponiert sein.

Die Erdstange muss mit der Anlagenerdung verbunden sein. Das Erdungskabel darf bei Entladungen nicht berührt oder betreten werden.

8 Dangers et indications de sécurité (French)

Indications générales

Une installation haute tension représente en général une source de dangers non négligeable pouvant causer des accidents. Veuillez donc observer en général les indications et les prescriptions de sécurité suivantes.

Le système de commande OT257 AC doit être manipulé exclusivement par du personnel dûment **instruit**.

La haute tension ne doit être activée que si toutes les conditions de sécurité sont remplies. Voilà pourquoi, le pontage des dispositifs de sécurité de l'installation et du pupitre de commande est interdit.

Le circuit de sécurité ne doit en aucun cas être court-circuité. Le circuit de sécurité doit être conduit autour de l'installation, et tout accès à l'installation devrait interrompre le circuit de sécurité (par ex. rodage des contacts de porte, etc.) .

Dangers lors de travaux au niveau du pupitre de commande

Le pupitre / rack du système de commande OT257 AC est une unité complète qui ne recèle normalement aucun danger pour l'utilisateur. Les points suivants doivent néanmoins être observés

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Le système de commande ne doit être utilisé dans un système de test haute tension que si la vis de mise à la terre sur la face arrière du pupitre de commande est reliée à la prise de terre globale de l'installation.

Sur le pupitre de commande, les lignes de raccordement au secteur ne sont plus couvertes lors d'un démontage des panneaux arrière et frontaux. Voilà pourquoi, le raccordement au secteur du système de commande doit être enlevé avant l'exécution de tout travail de démontage. Les lignes sous tension ne sont plus marquées spécialement à l'intérieur du pupitre et des différents appareils.

Comme la haute tension ne peut, normalement, être activée que sur le pupitre de commande, il incombe à l'utilisateur du système de commande de veiller à ce que la présence de personnel dans la zone de sécurité soit évitée lorsque la haute tension est activée.

Précautions de sécurité lors de travaux sous haute tension

Pour des raisons de sécurité, les travaux sous haute tension devraient toujours être surveillés par une deuxième personne. Le personnel de montage et de service doit connaître les règles de conduite en cas d'accidents causés par la haute tension.

Tous les commutateurs d'arrêt d'urgence doivent être accessibles en permanence, l'un des commutateurs devant être fixé au pupitre de commande. Ce commutateur est livré avec l'installation et peut être fixé par aimant au pupitre.

Le circuit de sécurité ne doit être interrompu que lorsque la haute tension est désactivée.

Il est interdit de franchir le circuit de sécurité et les barrières.

Dangers de l'installation à haute tension

Il est possible que les éléments de construction pour la haute tension, notamment les condensateurs, soient chargés même lorsque la haute tension est désactivée. Voilà pourquoi, ils devront être déchargés dans tous les cas à l'aide de la perche de mise à la terre. Les outils requis pour cela (par ex. perche de mise à la terre) doivent toujours être déposés près de l'installation.

La perche de mise à la terre doit être reliée à la prise de terre de l'installation. Lors de décharges, il est interdit de toucher ou de marcher sur le câble de mise à la terre.

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9 Maintenance

The OT257DC control system is almost maintenance free. Nevertheless the following points should be observed:

Cleaning the Desk and the Screen

The desk can be cleaned with a moist cloth. Do not use chemicals or abrasives. Special cleaners for screens are available in the larger department stores and computer shops. In an emergency, a moist cloth can be used.

PCI 811 Computer Battery

The lithium battery of the PCI 811 computer must be replaced approximately every 10 years. This battery drives the internal clock of the computer that ensures that the time as well as the date are always correct. Each file is automatically stored together with the current date and system time. These two parameters are aids in determining which are the latest files.

Fan

The PCI 811 fan is equipped with a filter, which must be cleaned or exchanged at regular intervals. Otherwise the computer can become damaged as a result of insufficient heat exchange. Haefely will not accept any guarantee damage claims in such cases.